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THE NATURAL CONTROL OF HETEROCAMPA GUTTIVITTA[1]

By W. F. FISKE and A. F. BURGESS, *Melrose Highlands, Mass.*

In the April issue of the Journal, page 16, appeared an article by Mr. Burgess concerning the abundance of *Calosoma frigidum* in New Hampshire during the previous summer. Data were given showing that in areas where the beetle larvæ had finished feeding 78 per cent. of the pupæ of *Heterocampa guttivitta* had been destroyed, and where the larvæ were about one-half grown 54 per cent. of the pupæ of this moth had been killed at the time of the last examination, August 21–25, 1909. In view of these facts it seemed desirable to continue the observations this summer, in order to determine whether the work of this beneficial beetle, or of any parasitic insects, might be bringing about the natural control of *Heterocampa*. Accordingly,it was planned to make several trips to the region visited last year in the vicinity of North Conway. Mr. Harry S. Smith spent from July 10 to July 13 in this section making observations and collections on Mount Kearsarge, White Horse Cliff and various other ranges in the vicinity. Localities were visited where the trees had been very slightly to completely denuded by the caterpillars during the previous year, but Mr. Smith was able to find only an occasional larva of *Heterocampa* and very few specimens of *Calosoma frigidum*.

An examination of the earth showed that a very large percentage of the *Heterocampa* pupæ had been eaten by *Calosoma*, and that only a few moths had emerged in a normal manner. In spite of this, however, numerous eggs of the moth were found deposited singly on the leaves of beech and other trees. Mr. Smith noticed that most of these

[1] Occasional contribution from the Gypsy Moth Parasite Laboratory No. VI.

eggs had apparently hatched, but, on more careful examination he found that nearly every one had been attacked by a minute egg parasite. In a beech grove on the southern slope of Mount Kearsarge a count of 56 eggs of *Heterocampa* gave the following results:

Number containing prepupæ of parasite	35
Number from which parasites had emerged	14
Number from which caterpillars had hatched	2
Number of eggs apparently dead	5

This shows that the percentage of parasitism in this case equaled 87.5. Only one pupa was found in each parasitized egg, and no larvæ of the parasites were observed. This was probably due to the fact that the observations were made a little too late in the season to secure the early stages of the egg parasite.

Mr. Smith brought specimens to the laboratory at Melrose Highlands from which were reared a considerable number of egg parasites. Examples have been submitted to Mr. C. T. Brues of the Bussey Institution of Harvard University, who has identified them as very similar, if not identical, with *Telenomus graptæ* Howard.

On July 24 Mr. Fiske, accompanied by Mr. Reginald Wooldridge, of this laboratory, visited the region near White Horse Cliff where observations were made by Mr. Smith about two weeks previous. No caterpillars or beetles were found and conditions were much the same as those reported by Mr. Smith. Evidence of the work which had been done the previous year by *Calosoma* was very easy to obtain, and eggs of *Heterocampa* which had been parasitized by *Telenomus* were present on the foliage. Out of eighty eggs examined by Mr. Fiske, not one was found from which a parasite had not emerged, or in which a dead larva or pupa of a parasite was not present. Not one of the eggs had hatched and not a single caterpillar in any stage was observed.

Mr. Wooldridge continued his investigations at North Conway, West Ossipee, and Crawford Notch, but found very few *Heterocampa* larvæ, and only an occasional beetle. At Mount Cramer, North Conway, an examination of 29 eggs showed that 23 had contained parasites, and on Mount Kearsarge 29 eggs out of 33 examined in one locality, and 14 out of 16 examined in another had been destroyed by *Telenomus*.

In order to secure any further data that might be obtained a final examination of this territory was made by Mr. Burgess and Mr. C. W. Collins. The region which was badly infested near White Horse Cliff during the previous year was visited August 20. No evidence of the feeding of *Heterocampa* could be noted, but many of the trees showed

injury from the serious defoliation sustained the previous year. Examinations of the fallen leaves were made in order to determine the percentage of *Heterocampa* larvæ that had been destroyed the previous season, as well as to find out the average number of moths that emerged sucessfully. Mr. Collins continued the work and visited several localities near North Conway, Intervale, and Tamworth where the caterpillars had been abundant during the previous year, making counts of the pupæ found in badly infested areas and in sections nearby. The following table gives the summary of the counts made by him in the different localities and shows the number of pupæ destroyed by different natural enemies, as well as the number of moths which emerged in a normal manner. Twenty-seven out of 28 eggs examined by Mr. Collins were found to have been destroyed by *Telenomus*.

WORK OF HETEROCAMPA ENEMIES.

Areas examined.	Square feet.	Locality.	Pupae Destroyed by Calosoma	Pupae Destroyed by parasites	Pupae dead.	Moths emerged.
13	28	White Horse Cliff	62	...	...	2
10	19	Mount Kearsarge	35	2	...	6
5	13	Mount Hurricane	19	...	...	5
16	26	Mount Surprise	106	...	2	17
8	16	Tamworth, N. H.	15	...	2	1
11	19	Tamworth, N. H.	75	...	7	3
63	120		312	2	11	34

By computing the totals in this table it will be found that 87 per cent. of the *Heterocampa* pupæ in the region were destroyed by the larvæ of *frigidum* during August, 1909, which is slightly higher than the figures secured last summer, and 3.66 per cent. died from the attack of parasites or from other causes. The small percentage of moths—9.33—which emerged during the spring would undoubtedly have caused some injury to the foliage had it not been for the intervention of the tiny egg parasite already mentioned, although it is fair to assume that the caterpillars would have been seriously decimated by the swarm of *frigidum* beetles which must have developed from the large number of larvæ of the previous year. If we assume that the sexes of the moths were evenly divided, it is apparent that on the average only one female was developed from 21 pupæ of the previous year. This enormous reduction which was caused by the work of *Calosoma* is, of course, of great importance, still it must be remembered that each *Heterocampa* female is capable of depositing 500 or more eggs according to observations made by Miss Patch on this insect in Maine. It, therefore, is clear that the primary factor in bringing *Heterocampa* under natural control, aside from the work of *Calosoma frigidum* was due to the little egg parasite.

The observations made failed to show that Tachinid parasites played any important part in checking *Heterocampa*. A single caterpillar was found in 1909 which contained a large number of small maggots of an unknown species. This is the only instance where Tachinid parasitism was noted. Owing to the careful examination of a considerable area of leaves and soil it is inconceivable that the puparia of parasitic flies could have been overlooked if they had occurred in any great abundance.

Hymenopterous parasites on the immature caterpillars appeared to be lacking, or nearly so. None were found directly associated with *Heterocampa*, but cocoons of *Limnerium* similar to, and perhaps the same as the species which has been determined as *Limnerium clisiocampæ* Ashmead, were found in small numbers on abundantly infested trees in 1909. *Pimpla pedalis* and *Ichneumon* sp. were sufficiently abundant as parasites on pupæ in 1909 to cause considerable mortality, but since the pupæ were particularly liable to destruction by the larvæ of *Calosoma*, the parasites in turn suffered to a great extent and their utility was materially reduced.

The same scarcity of *Heterocampa* which obtained in New Hampshire this summer was also noted in Maine. During 1909 this insect was abundant to a greater or less extent throughout southwestern Maine. Practically all of the towns west of Boothbay, Augusta, Winslow, Clinton, Skowhegan and south of Madison, Stark, Farmington, and Bethel were infested to a greater or less extent and in many sections large areas were completely defoliated.

On August 13 Mr. Burgess visited a number of towns in the southwestern part of the state, but not a single larva of *Heterocampa* was seen and although diligent inquiry was made of many persons who travel to a greater or less extent over the territory which was infested the previous year, not a single instance could be found to indicate that *Heterocampa* was at all abundant or that any trees had been stripped by it this summer. In company with Capt. E. E. Philbrook and Mr. E. M. Sadler a visit was made to Mount Agamenticus, and during this trip a region was passed through which had been defoliated by *Heterocampa* in the summer of 1909. The trees showed no evidence of feeding by this species, although some of the oaks had been eaten by other caterpillars. Mr. A. M. G. Soule, one of the gypsy moth inspectors of the Maine Department of Agriculture, stated that he had seen a few *Heterocampa* larvæ in the region near Mount Agamenticus this summer, but not in sufficient numbers to do any damage or cause defoliation. He reported *Calosoma frigidum* as abundant last year and as occurring in larger numbers this summer.

A question which naturally arises is what has become of the large

numbers of beetles which were developed from the unusual abundance of larvæ in 1909. It is probable that in New Hampshire these beetles migrated to localities where other food was available and undoubtedly many of the native caterpillars which occur every year in greater or less numbers were destroyed by them. The investigations at the gypsy moth parasite laboratory have shown that beetles of this genus are able to survive for a long time without food and that in case the food supply is scanty only a small number of eggs are laid. This probably indicates what has happened in the *Heterocampa* regions in New Hampshire, so that on account of the relative scarcity of the food supply it is probable that the reproduction of this beneficial species has been greatly curtailed. Interesting information in this respect has been secured from the men engaged in the gypsy moth work in Maine. Capt. Philbrook states that during the summer his men continually reported large numbers of *Calosoma frigidum* in sections infested with the gypsy and brown-tail moths. The species had been found in previous years, but only in limited numbers compared with this year and it is apparent that many had migrated from the *Heterocampa* infested region in search of food. Mr. Soule states that on the Chase lot near the foot of Mount Agamenticus about three *frigidum* beetles were found under each burlap while on the Fitzgerald lot nearby the species was even more abundant. In several instances this beetle has become so abundant in southwestern Maine during the past summer as to cause complaint or inquiry by citizens. During June one of the summer residents at Cape Elizabeth, Me. sent to the laboratory specimens of this insect and a statement that they were found crawling on his grounds, trees and buildings in large numbers and were causing some alarm among the residents owing to the belief that they might be of a poisonous nature. Early in July a letter was received from Miss Harriet S. Gilbert from Prout's Neck, Me., together with a specimen of the beetle. In it she states that "for the past three weeks they have been all over our house, inside and out," and asked if they were beneficial or injurious, and if the latter what measures should be taken to destroy them. The last two instances show that there has been an enormous increase in this species in southwestern Maine, and probably a general migration from *Heterocampa* districts to gypsy and brown-tail moth regions, as it has been observed that this species is capable of flight, although no accurate data are at hand to show the distance to which they may be dispersed in this way.

From the habits and life history of *Calosoma frigidum* and *Telenomus graptæ* it appears that they are admirably suited as a natural means of controlling *Heterocampa*. What conditions could have brought

about the remarkable increase of the latter species during the past few years is difficult to conjecture, but there can be no question of the effective manner in which they have supplemented each other's work and reduced the numbers of *Heterocampa* to a minimum. This same principle, namely, the sequence of natural enemies working together in harmony on different stages of the host is what is hoped may be the final result of the introduction of parasites and natural enemies of the gypsy and brown-tail moths which is now being attempted in Massachusetts.

FUMIGATION BOX MATERIALS

By W. E. Hinds, *Entomologist to Alabama Experiment Station*

In connection with investigations relating to fumigation, the writer, assisted by Mr. W. F. Turner, has had occasion to test a variety of materials such as are commonly used in fumigation boxes or tents, to determine their comparative resistance to the transmission of air. The economic entomologist is frequently called upon to recommend materials and types of construction for fumigation outfits. This paper is offered in the hope that the experiments reported may be valuable for their suggestions in this direction. Naturally the material with which fumigation treatment is to be made is one of the first factors to be considered.

Our work thus far has been principally with carbon di-sulfid and with this substance, the problem of constructing a gas-tight container is complicated especially by its chemical properties. One volume of carbon di-sulfid liquid is supposed to produce 375 volumes of vapor. Naturally therefore, in a closed container, the pressure of gas from the evaporating liquid is a considerable factor. In an experiment to determine the amount of this pressure, a two-necked Wolff bottle was used as the container. In one opening a mercury manometer was tightly fitted through a rubber stopper. Through the other neck, a small quantity of liquid carbon di-sulfid was introduced and the opening then closed tightly with a rubber stopper coated with glycerine. In this tight apparatus, the pressure produced by the evaporation of the liquid at a room temperature of 60 degrees F., amounted in a few minutes to more than 2.5 pounds per square inch, or more than .15 of an atmosphere. At higher temperatures, the pressure would be very much greater than this. In all ordinary fumigation chambers, the leakage has been found to be so great that the evaporation of liquid carbon di-sulfid produces no increase of pressure even with a

water manometer, which is far more sensitive than the mercury instrument.

Furthermore, carbon di-sulfid is one of the best chemical solvents known for waxes, varnishes, oils, etc., such as might be commonly employed in rendering boxes gas-tight for hydrocyanic gas fumigation. Paint, varnish, putty, paraffin, tarred paper, etc., are very soluble in carbon di-sulfid liquid or gas and cannot, therefore, be used as finish-coats where this material is the fumigant.

One of our first objects was to find some material which was insoluble in carbon di-sulfid liquid or vapor. Glycerine proved to be an effective sealing agent between ground glass surfaces, as in stop-cocks, stoppers, or under bell jars, where the pressure produced by the gas would not be sufficient to lift or separate the surfaces. Animal glue appears to be entirely insoluble in di-sulfid and, at first thought, it appeared that this material might be satisfactory for painting over woodwork, sealing joints, cracks, etc., in fumigation boxes. A difficulty soon appeared in the case of glue, however, as external coats are likely to crack and peel, thus rendering them practically worthless. Water glass is another material which, when dry, appears to be resistant to the di-sulfid vapor. But water glass cracks even worse than does glue when applied to wood surfaces. Cracking may be reduced to a considerable extent by adding about 10 or 15 per cent. of glycerine to the water glass, but even then it is unsatisfactory.

As a general rule for fumigation tents to be used with hydrocyanic acid gas, about 8 ounce duck is employed. In most cases, this is not treated with any filling solution to reduce the porosity of the cloth and recent reports of experiments in tent fumigation indicate that leakage is so large a factor that fumigation is unreliable if there be any considerable wind blowing. Double and triple filled duck can be used and are improvements over the ordinary grade.

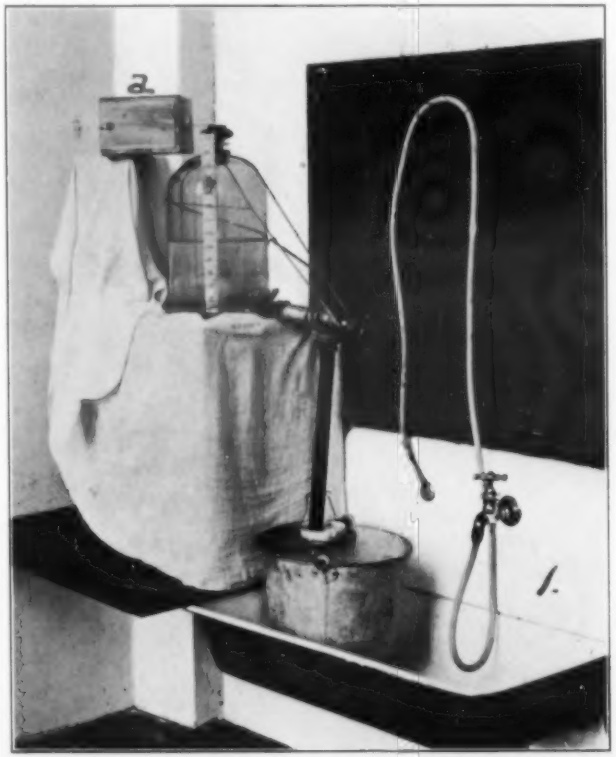
For fumigation boxes with either hydrocyanic acid gas or carbon di-sulfid, the materials most commonly used are probably matched flooring laid double with paper lining between. The paper is usually well overlapped but the edges not tightly sealed together. In fitting doors and movable windows, various grades of felt or of folded cloth are commonly employed for the bearing surfaces.

In our experiments, most of the tests have been made with various weights and qualities of duck but other materials have been included and some of these have been treated in various ways. Few people have any definite conception of the real difficulty of constructing an absolutely air-tight fumigation box. Most woods are decidedly porous and especially so if they are cross-grained. In an attempt to construct a small air-tight box, in which an aneroid barometer might be placed

to give measurements of pressure when connected with various experiments, it was found very difficult to secure absolute tightness even when the interior was thoroughly coated with glue and the exterior likewise covered with paraffin.

The apparatus used in making the tests here reported was designed to give comparative results rather than an absolute measurement of the porosity of a given area in the materials tested. The idea involved is certainly not new and has, I think, been employed by Dr. A. W. Morrill and Mr. W. W. Yothers in tests of tent materials in white fly investigations in Florida. The accompanying illustrations (Plate 25, figures 1 and 2) give a fair idea of the apparatus used. A large aspirator bottle was elevated to such a height that a column of water varying from 17 to 27 inches in height, could be utilized. Steam valves arranged to make air-tight connections through rubber stoppers were fitted to both inlet and outlet openings. The outlet pipe opened under water to prevent air being drawn back into the apparatus when a partial vacuum was produced. This was arranged, however, so as to overflow and not affect the uniformity of pressure at the outlet. The samples tested were placed in the union coupling at the upper left hand corner of the apparatus, where they were clamped between two metal surfaces. With the upper valve closed, and the lower valve open, water could escape until equilibrium was established. The height of the water surface in the bottle was then read upon the scale and the upper valve quickly opened. The amount of water which then ran out in a given period of time depended entirely upon the amount of air which could enter through the material placed in the union. If the material were air tight, no water could escape. If the material were very porous, water would escape rapidly. In the comparison of materials, the percentage of porosity is based upon the ratio of the inlet of air through the material under test as compared with the inlet of air through the apparatus with no material enclosed. That is, with the union joint entirely free and open, the percentage was taken as 100. The area of the samples as used was actually .44 of a square inch, but this area does not affect the comparison made.

In the table given below, the materials have been arranged in order of the increasing percentage of porosity ranging from those which were air tight to those which retarded the inlet of air but very little.



Apparatus for testing the porosity of cloths, etc., for fumigation outfits; 1a Aneroid barometer box; 2b Union coupling in which samples were placed for test (Original).

Most of the samples of duck used were obtained from Hettrick Bros., Toledo, Ohio. In reference to the samples of brown waterproofed ducks, Nos. 1, 2, 3, 8, 16 and 26, it appears that the lighter weights are fully as satisfactory in their gas-proof qualities and are less injured by severe handling than are the heavy weights. The coating on this material was but slightly soluble in liquid di-sulfid and would probably

COMPARATIVE AIR POROSITY OF FUMIGATION MATERIALS

Sample No.	Material and Treatment.	Percentage of leakage.
1	7 oz. duck, Hettrick Bros., brown waterproofed	0
2	8 oz. duck, " " " "	0
3	10 oz. duck, " " " "	0
4	Good grade bond letter paper, coated with water glass	0
5	Extra heavy ledger paper, untreated	0
6	Rubberoid roofing paper, two ply	0
7	Light weight bond letter paper	1.8
8	7 oz. waterproofed duck, severely crumpled and rubbed for one minute	4.2
9	10 oz. duck, treated with one coat of glue containing some glycerine and water glass	7.1
10	10 oz. duck, with one coat of glue with glycerine only	9.5
11	10 oz. duck, with one coat of glue with some glycerine and one-half as much water glass	12.0
12	Plaster of Paris, sheet 1-10 to 1-12 inch thick, dry	19.0
13	Plaster of Paris, sheet 1-10 to 1-12 inch thick coated with vaseline	28.6
14	10 oz. duck, with one coat of water glass, thinned with glycerine each side	33.3
15	10 oz. duck, with two coats water glass, as above on one side	33.3
16	8 oz. brown waterproofed duck severely rubbed one minute	38.0
17	20 oz. duck, untreated	40.0
18	14 oz. duck, untreated	42.9
19	10 oz. duck, with one coat water glass and no glycerine on one side	47.8
20	10 oz. duck, with one coat water glass, thinned with glycerine on one side	52.4
21	10 oz. duck, one coat water glass each side	52.4
22	14 oz. paraffined duck	61.9
23	18 oz. duck, untreated	67.6
24	16 oz. paraffined duck	67.9
25	16 oz. duck, untreated	76.2
26	10 oz. brown waterproofed duck, severely rubbed	76.2
27	Canoe duck, untreated	78.6
28	8 oz. army duck	81.0
29	16 oz. paraffined duck, severely rubbed	81.0
30	10 oz. duck, untreated	85.7
31	Heavy gray felt, very spongy (weight 256)	90.5
32	7 oz. army duck	95.2
33	Thin cotton cloth, treated with "Preservo," (a waterproofing solution)	95.2
34	Green felt, (piano-action felt) somewhat compressed	95.2
35	Soft gray felt, (weight 285)	95.2
36	Gray felt, (weight 181)	95.2
37	Thin red felt	95.2
38	Apparatus entirely open	100.0

prove resistant for a long time to the vapor. Paraffined duck samples 22, 24 and 29, while thoroughly water-proof, contained many comparatively large air holes, which place them all high in the percentage of leakage. They were in fact even more porous than untreated samples of the same weight. The addition of a small percentage of glycerine in solutions of glue rendered the glue much less brittle, less liable to cracking and slightly less porous than where glycerine was omitted. The difficulty with all glue-coated samples seemed to be that small airholes were formed in the coating, even on smooth surfaces, which opened when the glue dried and hardened, permitting the passage of air even in cases where both sides of the cloth were treated.

It is noticeable that all the samples of felt are among the most porous of the materials tested. In fact they have very little resistance

to air passage if they are at all soft and springy. It is equally noticeable that the paper samples transmitted very little, if any, air.

These results suggest that in the construction of fumigation boxes, we should depend for gas-tightness upon heavy paper, with the edges and overlappings securely sealed, as by gluing, more than upon the quality of lumber, the tightness of the joints, or even a finishing coat, with any material which we have yet tested for resistance to carbon di-sulfid vapor. With hydrocyanic gas, there will be less difficulty because of its lack of the solvent power possessed by the carbon di-sulfid.

APHELINUS DIASPIDIS HOWARD

By H. J. Quayle

This chalcid (*Aphelinus diaspidis* Howard) is by far the commonest parasite of the red or orange scale (*Chrysomphalus aurantii* Mask.) in California; in fact, it is the only one of any economic significance. It may be found throughout the citrus belt of southern California, and, while in some places on trees badly infested with the red scale, it may seem rather common, it cannot be counted a very important control factor, since the maximum parasitization found thus far has not exceeded five per cent.

This insect is commonly spoken of as an internal parasite, yet strictly speaking, so far as the scale insect itself is concerned, it is an external parasite. That is, while it may be under the scale covering, it is not within the body of the scale itself like those of the Soft Brown or Hemispherical Scales, or the various parasites that are entirely surrounded by the body tissues of their host.

The *egg* is yellowish white in color, ovate in form, measuring .16 mm. long and .96 mm. wide. There is a conspicuous micropyle projecting from the narrower end and also attached to this a short stalk that is doubled back on itself. The chorion is smooth, with spherical granular bodies showing through with transmitted light.

The *larva* when full grown appears as a more or less structureless top-shaped globule, measuring, when segments are normally extended, .75 mm. long and .5 mm. wide. It tapers considerably more toward the posterior end, and there is a slight difference between the dorsal and ventral surfaces. The distance between the upper and lower surfaces is a little less than the width of the body so that there is some indication of flatness. The color is glossy white, with the food in the digestive tract showing distinctly yellow, oval in shape and measuring about one half the dimensions of the larvæ itself. There are 14 indistinct segments including the button at the tip. The head end is

broadly rounded, contrary to what might be expected, with the first segment disc shaped and firmer than the others, with the small mouth opening in the center. This mouth opening is about 20 μ in diameter and there are two chitinous spines projecting toward its center in front. These spines are 18 μ in length and 15 μ wide at the base where the muscle attachment occurs. From near the base they suddenly narrow into a sharp pointed spine which is chitinous at tip and brown in color. These are used for piercing the outer wall of the scale and for holding in place while the fluids are sucked from the body.

The *pupa* is dark yellow in color, with ocelli and eyes reddish brown and a similar pigment extending around the anterior margin, and to a less extent about the posterior margin, of the head. Length .75 mm., width .375 mm. The adult appendages, enclosed in their sheaths, lie close to the body on the ventral side. Always accompanying the pupa are from 6 to 10 black or dark brown torpedo like bodies .125 mm. long and .055 mm. broad, which are evacuations from the digestive tract and are expelled by the larva preliminary to pupation.

The duration of the egg stage is from 4 to 5 days, of the larval stage 12 to 16 days and of the pupal stage 8 to 10 days. The adult[1], under nearly normal conditions, usually died in 4 or 5 days.

This parasite does not always emerge through an exit hole in the scale, but very commonly simply pushes its way out from under the scale. The scale covering seems to be loosened from the surface in most cases so that this means of emergence is comparatively easy. This is further brought about by the movement of the parasite, and also because of the fact that the scale covering is always separated from the insect and has a chance to loosen before the parasite is mature. In case, however, the scale covering is held securely to its resting surface the parasite eats out an irregular, rectangular usually, hole in the scale covering just beyond the molted skin, in the case of female scales, and at the posterior third in the case of male scales. The parasite almost invariably is lying on its back as a pupa. Not infrequently two pupæ are found under one scale and one case has been observed where there were three.

The egg is deposited under the scale covering, but either on the upper or lower side of the insect itself, most commonly on the lower. It is not inserted within the body of the scale insect. Preliminary to oviposition a thorough examination is made of the scale by alternately tapping with the antennæ from the center of the scale to the periphery. Upon reaching the edge of the scale a rapid backward movement is made at the same time turning slightly around so that the entire

[1] The adult of this insect has been described by Howard in the Ann. Rep. U. S. D. A. for 1880.

surface is explored by the antennæ in from five to eight backward and forward movements in a remarkably short time. This procedure may occur with but one scale before the ovipositor is inserted, and again, two dozen or more may be gone over without finding a suitable scale for oviposition. But the parasite does not rely alone on the exploration with the antennæ, for the ovipositor may be inserted many times without any eggs being deposited. Insertion with the ovipositor may occur with the insect beneath in various conditions, and not infrequently it is dead and shriveled up. But exploration by the ovipositor is the final reliance for the placing of the egg.

A specific case will serve to illustrate the behavior during oviposition. Parasite inserted ovipositor and laid egg in scale No. 1 occupying five minutes. One insertion was made in each of three other scales occupying from 1 to 3 minutes each. No eggs deposited. In scale No. 5 ovipositor inserted 11 times and remaining in scale as follows: 1 min.; 3-4 min.; 1 min.; 1 3-4 min.; 1 min.; 1 min.; 1 1-4 min.; 1 min.; 3-4 min.; 1 1-2 min.; 6 3-4 min. Scale lifted and but one egg deposited, this undoubtedly at last insertion.

Eggs may be deposited under scales of various stages as follows: Female between 1st and 2nd moult and between 2nd moult and egg laying. Male after 1st moult, propupa and pupa. In no case has a larva of the parasite been seen with a scale during the moulting period or during the egg-laying period. The scale during these periods is very different than at other times. The body wall is hard and glassy, while the contents are more fluid and the insect adheres firmly to the scale covering. Between the moults the body wall is flexible, is not so distended by the body fluids, and the scale covering very readily separates from the insect itself. This last point accounts for the readiness with which the covering is lifted in many cases to allow the escape of the parasite.

In the June number of this JOURNAL Dr. Howard[1] has an interesting article on the feeding habits of certain of these chalcid parasites. Observations are recorded upon four species that feed at the puncture holes made by the ovipositor. In the case of *A. diaspidis* only two or three times has any indication of this habit been noticed and then it was not certain that they either fed at the puncture hole or sealed it. At any rate, this cannot be counted a common habit with this species, for many hundreds of insertions have been observed during the past three summers. Observations have been made, however, on this species feeding on a droplet of honey dew, and also some evidence that they feed on plant tissue. They have been observed many times

[1] On the Habit with certain Chalcidoidea of Feeding at the Puncture Holes made by the Ovipositor. By L. O. Howard.

lying prone upon the fruit itself working the mandibles and going through all the movements of feeding. But if the surface tissue was actually penetrated it was too small to be observed with a low power lens. This habit of feeding on plant tissue is very common with the Soft Brown Scale (*Coccus hesperidum*) parasite (*Coccophagus lecanii*) and here very distinct feeding marks are left in the form of narrow strips of the surface tissue gouged out.

In a considerable number of specimens collected from various places during the past three seasons no males have yet been taken. That this species may reproduce parthenogenetically there is no doubt, for a female just emerging was placed in a glass vial for two or three hours and upon being liberated on a scale infested orange there was immediately deposited beneath a scale an egg, which later hatched.

THE ORANGE TORTRIX

(*Tortrix citrana* Fernald)

By H. J. QUAYLE, *Southern California Laboratory, Whittier*

This insect was first described in 1889 by Professor C. H. Fernald[1] from specimens bred from oranges from southern California by Mr. D. W. Coquillett.[2] Complaints of it have occurred from time to time since, but with the exception of occasional years, it has not occurred in sufficient numbers to attract much attention. According to Coquillett, considerable inquiry was made about the insect in 1894[2] and also again in 1898.[3]

During the season of 1909–10 this insect was the cause of no little concern in certain sections of the southern California citrus belt. It seemed to be most abundant in Los Angeles County from Glendale to Pomona, very few being seen further east in the Riverside-Redlands district. In some of the packing houses during the early part of the shipping season the amount of wormy fruit ran between 5 and 10%.

Coquillett states that " ordinarily it lives in a rolled or folded leaf, upon which it feeds, but it also has the habit of burrowing into the green oranges." This latter habit of burrowing into the fruit really seems to be the most common. Very little evidence of rolled or folded leaves was noticed in the infested groves and the worms kept under observation in the laboratory seemed to attack the fruit in preference to the leaves.

[1] Ent. Amer. Vol. V p. 18, 1889.

[2] Bull. 32, Div. Ent., U. S. D. A., p. 24, 1894.

[3] Bull. 18, New Series, Div. Ent. U. S. D. A., p. 99, 1898.

This insect appears to attack a wide range of food plants aside from the orange. Coquillett (*loc. cit.*) states that it occurs on apricot, willow, oak (*Quercus agrifolia*), wild walnut, (*Juglans californica*) and golden rod (*Solidago californica*). On July 24th specimens of larvæ were received from Mr. I. J. Condit of San Luis Obispo which were attacking green house plants. Moths were reared from these and submitted to Dr. L. O. Howard at Washington and were identified by Mr. August Busck as *Tortrix citrana* Fernald. Mr. Condit states that they have been infesting various green house plants for several years, but have not spread out of doors except to some geraniums close by, and to various plants in the lath house. The green house plants listed are: "Wandering Jew, rose, seedling Acacias, seedling Eucalyptus, *Asparagus sprengeri* and *A. plumosus*, lavender, Jerusalem cherry, Pentas, Cineraria, Lantana, *Coix lachryma*, Begonia and ferns of various species. Pelargoniums were especially subject to attack and the larvæ seem to work into the tips and branches of these plants similar to a borer. Commonly they work in folds of leaves tied together by means of silk threads."

The injury to oranges is due to the burrows made in the fruit and usually these go no further than just through the rind. There is considerable variation in the character of the burrows, both as regards size and the depth they go into the fruit. Of course such fruit is classed as culls, and the holes are frequently the source of infection for decay following blue mold, navel end rot, and wither tip fungus. The burrows in the fruit also cause it to drop prematurely, especially if the fruit is still small, so that all of the injury chargeable to this insect is not accounted for in the packing house alone.

The eggs are laid on the leaves, either the upper or lower surface, but more usually on the lower, and also on the fruit. They are laid in masses of from 10 to 35, overlapping one another like shingles. An individual egg is cream color, measures about .75 mm in diameter, disc shaped, slightly convex on upper surface, and with a distinctly marked hexagonal network discernable with hand lens. Two or three of these masses may be laid by a single moth so that the total number of eggs may vary from 25 or 30 to 70 or 80. At the end of six days the two black eye spots of the developing larvae are visible and hatching occurs six days later.

The young larvæ are active and wriggle quickly away on being disturbed. A considerable amount of web is spun and the portion of the orange entered is sometimes covered with a thin network of silk. Larvæ in the insectary chose to enter the orange on the under side where it was resting on the surface. One entered along side a cell which had been attached by paraffin to the fruit. In the field the most

usual place of entry is where two oranges are in contact or an orange and leaf are in contact.

The full grown larva is about ½ inch long. The color varies from greenish white to dark gray, with broken irregular stripes more distinct in the darker specimens. During the growing period of the larva it remains almost continuously within the fruit, but upon reaching maturity it wanders about over the cage at night. During the day it is always found in its burrow. This traveling about off the fruit is no doubt for the purpose of finding a suitable place for pupation. In case no favorable location is found it will pupate within its burrow, first making a slight irregular cocoon. Pupation within the burrow is in fact, very common, though other places may be selected if available. The total length of the larval life is from 55 to 60 days and the pupal period from 9 to 12 days in midsummer.

The number of broods in a season is not very well defined and there is more or less overlapping. There does appear, however, to be a period in the spring when the moths are abundant, and again in the early fall. Moths were common in May and the first part of June and practically none seen in July and August. Moths appear again in September and possibly also again about December. Judging from the appearance of the worms and of the moths there is probably three generations, or two with a partial third generation.

Two species of Braconids (species not yet determined) have been reared from the larva. As for control measures, spraying with an arsenical has been suggested, but the worms would have to become more abundant than they have thus far to make this practical. The most feasible measure seems to be the picking up and destroying of dropped fruit in the field, while the larva is still within its burrow, and also the destruction of the wormy culls as they are sorted out in the packing house.

PLANT LOUSE NOTES, FAMILY APHIDIDÆ
(Continued), Plate 26

By C. P. Gillette

Aphidini

Aphis salicicola Thos., Figs. 1 and 2. Taken at Geneva, Albany, Webster and Woods Holl, on willow. I also have specimens from Massachusetts taken on willow by Dr. T. H. Morgan.

The long cylindrical cornicles, the single row of about 7 sensoria on third joint of antenna, and the very short second fork of the cubital vein seem to be the important distinguishing characters of this species.

Aphis sorbi Kalt., Figs. 3, 4 and 5. Taken at Webster, Amherst, Chicago, Geneva, Hood River and Portland, Ore., on apple. At Geneva and Webster this species was very abundant, rolling the leaves in a manner similar to the work of *A. pomi*. Prof. E. P. Taylor sent me this species from a few trees near Grand Junction, Colo., in 1907, which is the only record for this state.

In Bulletin 133 of the Colo. Experiment Station I referred to this louse as *A. pyri* Boyer, and am not now sure but it is Boyer's species, but a larger number of specimens for comparison have led me to think that it is *sorbi* of Kaltenbach, though the antennæ of the apterous louse are but slightly shorter than the body, and in the alate form they are somewhat longer, and the cornicles of the apterous form are very stout and tapering towards the free end as shown in Fig. 5.

Aphis ripariæ Oest., (?) Figs. 6 and 7. Very abundant on wild grape at Fort Lee, Washington, and Webster, on leaves, tendrils and tender new growths of the vine. This may be the *vitis* of Scopoli.

Aphis asclepiadis Fitch., Figs. 8 and 9. Taken at Chicago, Portland, Mich., Geneva, and Webster on *Asclepias* sp., and at Detroit on dogbane, *Apocynum.* sp. We have taken this species in Colorado at Fort Collins. The reference by Cowen in Bull. 31 of this station was an error.

Aphis pomi De G., Figs. 10 and 11. Taken on apple trees at Chicago, Portland, Lansing, Detroit, Albany, Geneva, Webster, New York City, Portland, Ore., and Hood River, Ore. This is an abundant species wherever the apple is grown in Colorado.

Aphis gossypii Glover, Figs. 12 and 13. In Chicago, abundant on *Philadelphus coronarius* and *Carduus arvensis* (Canada thistle); in Detroit on *Pyrus cornaria*, a few thrifty colonies, and at Central Park, New York City, on *Bursa b. pastoris*. Abundant on the eastern slope in Colorado where melons, cucumbers, squashes and cantaloupes are grown, but unknown upon the western slope.

Aphis spriæella Schouteden, Figs. 14 and 15. What I have taken to be this species was a very common louse upon bridal wreath, *Spiræa prunifolia*. Taken at Lansing (very abundant), Geneva, Detroit, Albany, New York City, Washington, Springfield, Webster, and Woods Holl. In general appearance resembling closely a small *A. pomi*. Was common one year, 1907, on spiræ on the campus of the Agricultural College at Fort Collins, but has not been seen in the state since. The antenna is hardly distinguishable from pomi except in size.

Aphis cardui L., Figs. 16 and 17. Taken on thistle, *Carduus* sp. at Geneva and very abundant about Portland and Hood River, Ore., and at Kansas City, Mo.

Aphis cephalanthi Thos. From button-bush, *Cephalanthus occidentalis*, at Webster, Mass., Figs. 18 and 19.

Aphis sambuci L., Figs. 20 and 21. What seems to be the typical form of this species was taken by Mr. Bragg at Webster, Mass., on *Sambucus* sp.

Aphis cerasifolii Fitch, Figs. 22 and 23. Taken at Webster and Geneva, where it was very abundant on the eastern choke-cherry, *Prunus virginiana*. This is a very common louse, curling the terminal leaves on limbs and sprouts of *Prunus pennsylvanica* wherever I have found this cherry growing in Colorado to an altitude of 8,000 feet.

Aphis bakeri Cowen. Taken at Corvallis and Portland, Ore., on red clover. We have taken this species from red clover or apple about Fort Collins, Denver, Rocky Ford, Canon City, Delta, Paonia, and Grand Junction in Colorado. Figs. 24 and 25.

Aphis brassicæ L. Taken at Corvallis, Ore., only, on rape. A very common species on both east and west slopes in Colorado where it is a serious pest on cabbage, cauliflower and rape. Figs. 26 and 27.

Aphis maidi-radicis Forbes. At Webster, on corn and at Washington on ox-eye daisy, *Chrysanthemum leucanthemum*. About Fort Collins this is a fairly common species on corn roots. Have also taken it on roots of *Helianthus* and on rhubarb. Figs. 28 and 29.

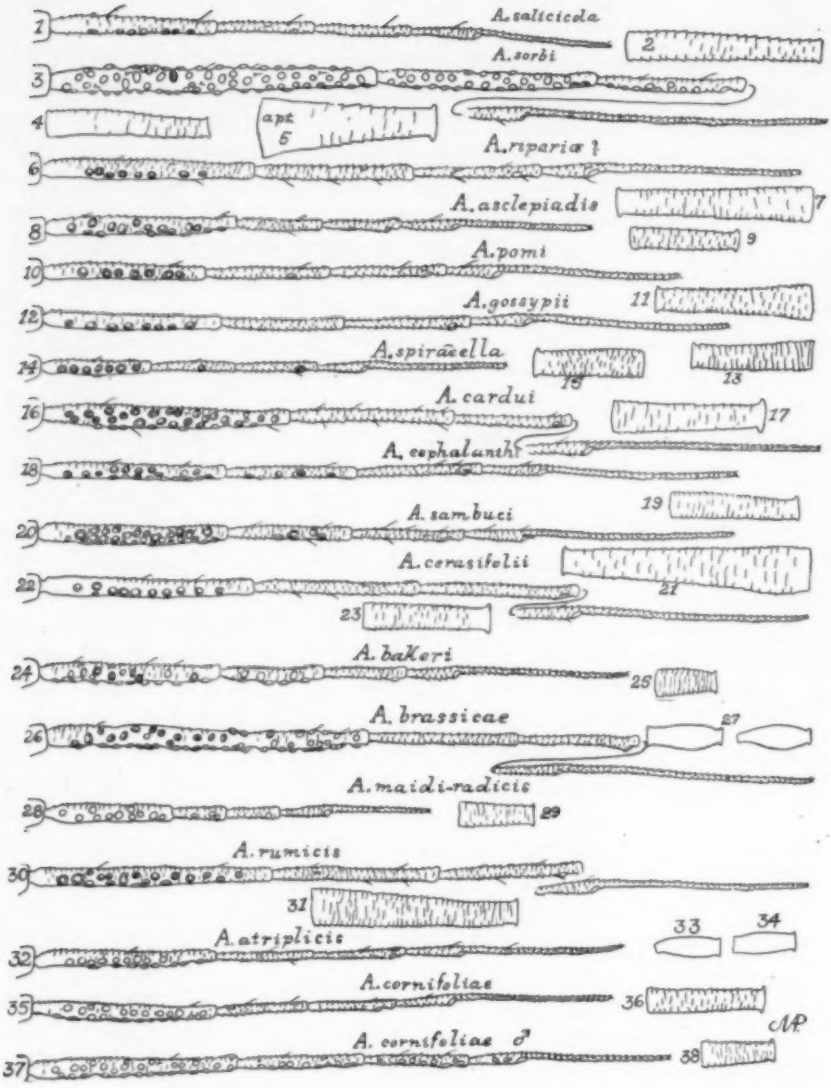
Aphis rumicis L., Figs. 30 and 31. Taken at Chicago on *Rumex crispus* (yellow dock), Lansing and Detroit on garden beets, Geneva and Washington, D. C., on burdock (*Lappa officinalis*), Corvallis and Oregon City on burdock, yellow dock and Lamb's quarter (*Chenopodium*), and at Seattle on Lamb's quarter.

The white spots and dashes upon the abdomen of the pupæ, and often of the apterous viviparæ of this black louse are quite characteristic and yet there is much danger of its being confused with closely allied species. Figures 30 and 31 are from alate lice taken from *Rumex crispus* at Chicago, June 23, 1909, and which agree well in structure with examples of this species sent me by Prof. T. D. A. Cockerell from Sussex, England, taken upon *Dipsacus* sp. and others labelled "*A. rumicis*" from H. F. Wilson, taken at Washington, D. C., Nov. 21, 1908, on *Rumex* sp.

Aphis atriplicis L. Taken at Portland, Mich., Geneva, New York City, Washington, and Corvallis and Hood River, Ore. This is a very abundant species generally distributed in Colorado upon both sides of the mountains and up to fully 7,000 feet altitude. This species was described by Mr. Cowen, in Bull. 31 of the Colorado Experiment Station as *A. chenopodii*. Figs. 32, 33 and 34 are from examples taken at Fort Collins, on *Chenopodium*, June 12, 1909.

Aphis cornifoliæ Fh., Figs. 35, 36, 37, and 38. Taken at Portland,

Plate 26



Antennæ of Aphididæ

Ore., August 20, 1909, on *Cornus* sp. The fall migrants were just beginning to form colonies on the leaves. This is an abundant species in Colorado, the eggs being deposited on twigs of *Cornus stolonifera* in the fall by apterous females that are the young of the migrants. In the spring the migrants leave the dog-wood and go to *Helianthus* for the summer. We have many times observed this habit in Colorado, and Mr. L. C. Bragg has artificially colonized this species both ways between these plants.

The figures are from fall migrants, taken at Fort Collins, Col., on *Cornus stolonifera*, Sept. 29, 1909. We have also taken this louse on *Iva xanthifolia* and in large numbers upon *Ribes aurem*. The male antenna is peculiar in having several sensoria upon all the joints beyond the second.

A. gillettei Cowen is a synonym of this species, but *helianthi* Monell seems probably to be a distinct species judging from an examination of balsam material sent me by Mr. Monell, and taken at St. Louis, Mo., July 7, 1910. Monell's specimens are somewhat smaller and have relatively shorter antennæ and cornicles, and the alate viviparæ lack the blackish patches at the base of each cornicle. The two forms, if distinct, are very closely allied. I find no difference in number or distribution of the sensoria.

Plate 26. *Aphididæ*. Unless otherwise marked, all figures are multiplied 70 times, and are from alate viviparous females. 1 and 2, *Aphis salicicola*; 3, 4, and 5, *A. sorbi;* 6 and 7, *A. ripariæ* (?); 8 and 9, *Aphis asclepiadis*; 10 and 11, *A. pomi*; 12 and 13, *A. gossypii*; 14 and 15, *A. spiræella*; 16 and 17, *A. cardui*; 18 and 19, *A. cephalanthi*; 20 and 21, *A. sambuci*; 22 and 23, *A. cerasifolii*; 24 and 25, *A. bakeri*; 26 and 27, (two views), *A. brassicæ*; 28 and 29, *A. maidi-radicis*; 30 and 31, *A. rumicis*; 32, 33 and 34 (two views), *A. atriplicis*; 35, 36, 37 (male), 38 (male), of *A. cornifoliæ*.—Miriam A. Palmer, Delineator.

A LIST OF THE APHIDIDÆ OF ILLINOIS, WITH NOTES ON SOME OF THE SPECIES

By JOHN J. DAVIS, *Office of the State Entomologist, Urbana, Illinois*

In this catalogue of the Aphididæ of North America (1901), Professor W. D. Hunter lists 98 species as having been recorded from Illinois. Since then, from records in literature and personal collections, the list has been increased to 170 species. Many more have been collected by us which we are at present unable to identify, either because of too little material or the apparent confusion of certain groups, which will require larger numbers of collections to work out satisfactorily. Following each species are one or more references to the most comprehensive descriptions of the various forms in Amer-

ican literature, together with brief notes on the economic importance, if any, and the first record of its occurrence in Illinois. An asterisk (*) before the species indicates that it is here recorded from Illinois for the first time, those having Illinois as the type locality are referred to by a "*t*" before the name, and those doubtfully occurring in Illinois, having only been reported by Hunter's compiled list.[1], so far as I have been able to find, are noted by a "*d*" before the name.

[t] *Tychea brevicornis* Hart: 18th Rept. St. Ent. Ill. (1894), p. 97, 1 fig. Not uncommon in Central Illinois on the roots of grass, *Euphorbia*, and corn, but of very little economic importance. First reported by Forbes.

[t] *Trama erigeronensis* Thos.: Hart, *loc. cit.*, p. 93, 1 fig. Common at Urbana, Ill., on dandelion roots, invariably attended by the ant, *Lasius flavus*. Also common on roots of *Erigeron canadense* and corn. First reported by Thomas.

[t] *Forda occidentalis* Hart: *loc. cit.* p. 95, 1 fig.. Common on grass and corn roots and occasionally injurious. First reported by Forbes.

[t] *Rhizobius eleusinis* Thos.: List of Aphid. U. S., Bull. 2, Ill. St. Lab. Nat. Hist. (1878), p. 15. I have never taken this species, which Thomas described from specimens collected on roots of *Eleusine indica* at Carbondale, Ill.

[d] *R. lactucæ* Fitch: 14th Rept. Ins. N. Y. (1872), p. 360. Thomas quotes Fitch, and there is no mention of its occurrence in Illinois.

[t] *R. poæ* Thos.: 8th Rept. St. Ent. Ill. (1879), p. 166. Mr. C. A. Hart considers this as probably a *Dactylopius*. First reported by Thomas, which is the only record of its collection, so far as I am able to learn.

[t] *R. spicatus* Hart: 18th Rept. St. Ent. Ill. (1894), p. 104, 1 fig. A rare species occurring on roots of grass, *Panicum*, and corn. First reported by Forbes.

Phylloxera caryæcaulis Fitch: Pergande, N. A. Phylloxerinæ, Vol. 9, Davenport Acad. Sci. (1904), p. 244, 2 figs. This is the commonest species of *Phylloxera* attacking hickory in Illinois, but like the other species of this genus it rarely becomes sufficiently abundant to require artificial means of control. First reported by Shimer.

P. caryæ-fallax Riley: Pergande, *loc. cit.* p. 214, 6 figs. First reported by Pergande.

P. caryæfoliæ Fitch: Pergande, *loc. cit.* p. 194, 2 figs. I have taken this hickory gall-maker on several occasions in Northern Illinois. My collection of winged females have been made throughout the month of June. First reported by Pergande.

[1] The Aphididæ of North America, by W. D. Hunter. Bull. Ia. Agr. Exper. Sta., No. 60, Sept. 1901.

[t] *P. caryæ-globuli* Walsh: Pergande, *loc. cit.* p. 222. (Quotes the scattered description of Walsh and Shimer.) I found this species on hickory at Lake Forest, Ill., June 29, 1909, the galls at that time containing large numbers of the winged individuals. After an initial determination by the writer, specimens were sent to Mr. Theo. Pergande who, in a letter of April 4, 1910, said, "The real *Phyll. caryæ-globuli* Walsh I had never seen before, though I think you may be right." First reported by Walsh.

[d] *P. caryæ-gummosa* Riley: 7th Rept. St. Ent. Mo. (1875), p. 118; Pergande, *loc. cit.* p. 238, 3 figs. I find no record of its occurrence in Illinois.

[t] [1] *P. caryæ-semen* Walsh: Pergande, *loc. cit.* p. 211, 2 figs. I do not know this species. First reported by Shimer.

[t] *P. caryæ-septem* Shimer: Pergande, *loc. cit.* p. 190, 7 figs. I am unacquainted with this hickory gall-maker. First reported by Shimer.

[d] *P. caryævenæ* Fitch: Pergande, *loc. cit.* p. 239, 10 figs. I find no record of its occurrence in Illinois, other than that in Hunter's Catalogue.

[t] *P. conica* Shimer: Pergande *loc. cit.* p. 225, 7 figs. First reported by Shimer.

[t] *P. depressa* Shimer: Trans. Amer. Ent. Soc., Vol. 2, p. 389 (Pergande *loc. cit.* p. 208, quotes Shimer). First reported by Shimer.

[t] *P. foveata* Shimer (=*foveatum* Shimer). Trans. Amer. Ent. Soc., Vol. 2, p. 393 (Pergande, *loc. cit.* p. 209, quotes Shimer). First reported by Shimer.

[t] *P. globosum* Shimer: Pergande, *loc. cit.* p. 236, 4 figs. Quotes and discusses Shimer's confused descriptions. First reported by Shimer.

[t] *P. minimum* Shimer: Trans. Amer. Ent. Soc., Vol. 2, p. 391 (Pergande, *loc. cit.* p. 210, quotes Shimer). First reported by Shimer.

[d] *P. rileyi* (Licht. MS.) Riley: Pergande, *loc. cit.* p. 261, 4 figs. I find no record of this species having been taken in Illinois other than that in Hunter's Catalogue.

* *P. salicola* Perg.: *loc. cit.* p. 267, 8 figs. This species is very common in some of the Chicago parks. It occurs in the crevices of the trunk and larger branches of the willow, appearing as small white flocculent masses, and when abundant, as it sometimes is, gives the willow trunks an unsightly appearance.

[t] *P. subelliptica* Shimer: Pergande, *loc. cit.* p. 239, 10 figs. Quotes Shimer in full. First reported by Shimer.

P. vitifoliæ Fitch (=*vastatrix* Planch.): Riley, 6th Rept. St. Ent.

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[1] Although Walsh does not give any definite locality, he very probably collected it in Illinois.

Mo. (1872), p. 30, figs. Common but of little economic importance in Illinois. First reported by Walsh.

[d] *Chermes pinifoliæ* Fitch: Patch, Bull. Maine Agr. Expt. Sta. No. 173 (1910), p. 277, 9 figs. Thomas named this species *abieticolens*, quoting the brief and unsatisfactory description of the gall as given by Packard and reproduced Packard's figure. Packard found the species in Maine and there is no reason to believe that Thomas found it in Illinois, as Hunter has supposed in his catalogue.

C. pinicorticis Fitch: Storment, 20th Rept. St. Ent. Ill. (1897), Appendix, pp. III–XXVI, figs. First reported by Walsh.

[t] *Geoica squamosa* Hart: 18th Rept. St. Ent. Ill. (1894), p. 98, 5 figs. Common on grass roots and occasionally on corn roots, but never, to my knowledge, in sufficient numbers to be injurious. First reported by Forbes.

[t] *Hamamelistes spinosus* Shimer: Pergande, Tech. Bull. Div. Ent., U. S. Dept. Agr., No. 9, p. 25, 12 figs. I have found this species very common on cultivated witch-hazel at Chicago, and wild witch-hazel growing in a timber at Kankakee. Of little economic importance. First reported by Shimer.

[t] *Pemphigus aceris* Monl.: Can. Ent., Vol. XIV (1882), p. 16. First reported by Monell.

* *P. betæ* Doane: Bull. 42, Wash. Agr. Expt. Sta. (1900), p. 3, 1 fig. Last September (1909) I collected wingless individuals of what I then determined as *Tychea brevicornis* Hart on the roots of *Bidens vulgata* at Oak Park, Ill. At that time only wingless forms were found. Later in the fall (Oct. 9), winged specimens were found on the roots of the same group of plants, a species I have determined as *P. betæ* after comparison with specimens received from Professor Gillette. The observations, although scanty, would seem to indicate the possible synonymy of the two species.

* *P. corrugatans* Sirr. (?): Ia. Acad. Sci., f. 1893, Vol. I, pt. IV (1894), p. 129. What I have been calling *Pemphigus pyri?* was found at Le Roy, Ill., July 7, 1907, corrugating the leaves of *Cratægus* sp. The pseudo galls and winged viviparous females agree fairly well with the description given by Sirrine for *P. corrugatans*, excepting the relative lengths of the antennal segments IV and V. In my Le Roy specimens segment IV is invariably slightly longer than V, while in the description of *corrugatans*, Sirrine gives Segment IV, .13 mm. and V, .17 mm. long.

[t] *P. formicarius* Walsh: Proc. Ent. Soc. Phila., Vol. I (1862), p. 308. This is an unknown species, it not having been reported since Walsh's original description. First reported by Walsh from Rock Island, Ill.

[t] *P. formicetorum* Walsh: *loc. cit.* p. 308. Nothing known of this

species excepting Walsh's original observations. First reported by Walsh from Rock Island, Ill.

* *P. fraxinifolii* Riley: Bull. U. S. Geol. Surv., Vol. 5 (1897), p. 17. Very common on green ash throughout the state, and one of the important pests of that tree. Further than the direct injury, the pseudogalls (curled leaves) of the insect gives the tree a very unsightly appearance. Specimens of this species were sent to Dr. G. Del Guercio who reported it distinct from the European ash *Pemphigus, P. nidificus* Löw. He has published an account of the differences in the two species in "Rivista di Patologia Vegetale," Anno IV, No. 4. The only additional contribution to the life history that we have to make is that the oviparous females are produced in the fall and are to be found in the crevices of the bark on the ash-tree trunk. These females produce but one egg each as do other Pemphigians.

P. populicaulis Fitch: Jackson, Columbus Hort. Soc., Vol. 22 (1908?), p. 191. This poplar gall-maker is common at Urbana, but I have failed to find it in Northern Illinois. First reported by Walsh.

* *P. populi-transversus* Riley: Bull. U. S. Geol. Surv., Vol. 5 (1879), p. 14, 1 fig. Common throughout the state on the cottonwood.

† *P. pseudobyrsa* Walsh: Proc. Ent. Soc. Phila., Vol. I (1862), p. 306. This is one of the unknown species. The original collection of the species by Walsh at Rock Island, Ill., appears to be the only record of its capture.

P. rhois Fitch: Jackson, Columbus Hort. Soc., Vol. 22 (1908), p. 202. First reported by Walsh.

† *P. rubi* Thos.: 8th Rept. St. Ent. Ill. (1880), p. 147. There is no reference to the collection of this species since the original description. First reported by Thomas.

* *P. tessellatus* Fitch: Jackson, Columbus Hort. Soc., Vol. 22 (1908?), p. 183; Patch, Ent. News, Vol. XIX (1908), p. 484, 1 pl. This species is injuriously abundant on the alders in the Chicago parks. I follow Miss Patch in considering *P. acerifolii* Riley a synonym. It has never been recorded from Illinois, except in Hunter's Catalogue and by Jackson, who seems to have followed Hunter.

† *P. ulmi-fusus* Walsh and Riley: Amer. Ent. Vol. I (1869), p. 109. A rare species which I have taken on elm at Leroy and Urbana, in the central part of the state. First reported by Walsh and Riley.

† *Mordwilkoja vagabunda* Walsh (*œstlundi* (Ckll.): Oestlund, Bull. Geol. and Nat. Hist. Surv. Minn., No. 4 (1887), p. 22. A common poplar gall-maker in Northern Illinois, especially abundant in the vicinity of Chicago. Often the street trees are so covered with these galls as to make them quite unsightly in winter. I have never taken this species south of Kankakee, Ill. First reported by Walsh.

* *Colopha ulmicola* Fitch: (*eragrostidis* Middl.)Riley, Bull. U. S. Geol. and Geog. Surv., Vol. 5, No. 1, (1879), p. 9; Patch, Bull. Me. Agr. Expt. Sta. No. 181 (1910), p. 196, 11 figs. A very common species. The galls are often so abundant on elms as to give the trees an unsightly appearance. As Miss Patch has recently pointed out, *C. eragrostidis* Middl. is doubtless a synonym of *C. ulmicola* Fitch.

* *Schizoneura americana* Riley: Bull. U. S. Geol. and Geog. Surv. Vol. V, No. 1 (1879), p. 4, figs. A common pseudo-gall-maker on elm and not infrequently injuriously abundant.

† *S. caryæ* Fitch: 3rd Rept. Ins. N. Y. (1856), p. 443. This species is unknown to the writer. First reported by Fitch.

S. corni Fabr.: Oestlund, Bull. Geol. and Nat. Hist. Surv. Minn., No. 4 (1887), p. 28. This is a common species on *Cornus sanguinea et* spp. throughout the state. First reported by Walsh under the name *cornicola* Walsh.

S. cratægi Oestl.: Bull. Geol. and Nat. Hist. Surv. Minn., No. 4 (1887), p. 27. A serious pest of the hawthorns used in ornamental plantings in Chicago, being especially common on *Cratægus crus-galli*. First reported by the writer.

ON *CRATÆGUS*, SEPT., 1909. DUNNING, ILL.

Antennal segment	Measurements in mm.							
III	0.4075	0.4075	0.3993	0.4075	0.4075	0.4156	0.4156	0.4075
IV	0.1222	0.1141	0.1141	0.1222	0.1222	0.1141	0.1222	0.1141
V	0.1385	0.1304	0.1304	0.1385	0.1385	0.1385	0.1385	0.1304
VI	0.1141	0.1141	0.1141	0.1141	0.1141	0.1141	0.1141	0.1141

S. lanigera Haus.: Gillette, Jour. Econ. Ent., Vol. I (1908), p. 306, colored and other figs. A common and destructive apple pest throughout the state. First reported by Thomas. Antennal measurements given below for comparison with *S. cratægi*.

ON APPLE IN GREENHOUSE, URBANA, ILL., 18 NOV., 1907.

Antennal segment	Measurements in mm.							
III	0.4156	0.4238	0.3993	.....	.....	.....	.....	.....
IV	0.1141	0.1141	0.1141	.....	.....	.....	.....	.....
V	0.0978	0.1059	0.0978	.....	.....	.....	.....	.....
VI	0.0978	0.0896	0.0815	.....	.....	.....	.....	.....

S. panicola Thos.: Hart 18th Rept. St. Ent. Ill. (1894), p. 90, 2 figs. Common on roots of *Panicum* and occasionally on corn roots, but of little or no economic importance. It has still to be proven that this is identical with *S. corni*. First reported by Forbes.

†*S. querci* Fitch: 5th Rept. Insects N. Y. (1859), p. 804. This species has not been recorded from Illinois since the first record by Fitch. I have taken a species on oak leaves several times in Northern Illinois, which is, I believe, the species referred to by Oestlund and Cowen as Fitch's *querci*. However my oak aphid, which is found in colonies beneath a rather dense cottony secretion, is a *Phyllaphis*, apparently undescribed, and will be described fully in another paper. First reported by Fitch.

†[1] *S. rileyi* Thos. (*ulmi* Riley): Riley, 1st Rept. St. Ent. Mo. (1869), p. 123. A serious pest of the elm throughout the state. First reported by Riley.

† *Mindarus abietinus* Koch (=*pinicola* Thos.): 8th Rept. St. Ent. Ill. (1880), p. 137; Patch, Bull. 182, Me. Agr. Expt. Sta. (1910), p. 242, 7 figs. This species has never been taken in Illinois since the original description. First reported by Thomas.

[d] *Phyllaphis fagi* Linn.: Thomas, 8th Rept. St. Ent. Ill. (1880), pp. 120, 140; Weed, Trans. Amer. Ent. Soc., Vol. 20, p. 303, 3 figs. (?) Other than in Hunter's Catalogue, this species has not been reported from Illinois.

Longistigma caryæ Harr.(? ?): Sanborn, Kans. Uni. Sci. Bull., Vol. 3 (1904), p. 30, figs. (*L. longistigma*). What has been heretofore known as *L. longistigma* on linden and *L. platanicola* on sycamore, are common throughout the state, the winged males and wingless oviparous females making their appearance during October in Northern Illinois, the large eggs being deposited in the crevices of the bark as well as on the smaller branches. First reported by Fitch (?).

[d] *Lachnus abietis* Fitch: Cat. Homopt. N. Y. (1851), p. 67. There is no record of the occurrence of this *Lachnus* in Illinois other than in Hunter's Catalogue.

†[2] *L. dentatus* Le B.: 3rd Rept. (2nd of Le Baron), St. Ent. Ill. (1872), p. 138, figs.; Weed, Bull. Ohio Agr. Expt. Sta., Tech. Ser., Vol. 1, No. 2 (1890), p. 117, figs. A common species in Northern Illinois, becoming very abundant in the fall, and on ornamental willows it is a considerable nuisance. First reported by Le Baron (?) .

[d] *L. quercifoliæ* Fitch: Cat. Homopt. N. Y., p. 67, 1851. This

[1] Chicago, Ill. and St. Louis, Mo., type localities.

[2] Although not definitely stated, Le Baron probably described this species from Illinois specimens.

species appears to be lost and it is doubtful if the species collected by Thomas in Illinois is the same as that described by Fitch in New York.

[d] *L. strobi* Fitch: 1st Rept. Ins. N. Y. (1855), p. 256; Weed, Bull. Agr. Expt. Sta. Ohio, Tech. Ser., Vol. 1, No. 2 (1890), p. 116, figs. This species has never been reported from Illinois except in Hunter's Catalogue.

[t] *Sipha flava* Forbes: Davis, Tech. Ser. Bur. Ent., U. S. Dept. Agr., No. 12, Pt. VIII (1909), p. 156. Common in Central Illinois on various grasses, corn, wheat, sorghum, and broom corn. On the latter two it often becomes destructive. First reported by Forbes.

* *Brachycolus tritici* Gillette Mss. I found this species common on grass at Aurora, Illinois, Sept. 24, 1908. Specimens were sent to Prof. C. P. Gillette, who replied that he had recently taken the species and had described it in manuscript under the above name.

[t] *Melanoxantherium smithiæ* Monl.: Bull. U. S. Geol. and Geog. Surv. No. 5 (1879), p. 32; Weed, Psyche, Vol. V (1889), p. 132. A species which often becomes excessively abundant on the branches of willow in the fall. In parks and other much frequented places these insects are a serious nuisance because of the blood-red stain caused when the soft-bodied aphids are crushed, this stain discoloring and ruining the clothing. First reported by Monell.

Chaitophorus aceris Linn.: Common on hard and Norway maples in Northern Illinois and apparently becoming more common every year. Although not a serious pest at present, it is likely to become one within a few years. It is found on the maples throughout the year, the sexual forms (winged male and wingless oviparous female) occurring in September and October. The dimorphs were not observed, which, however, may be accounted for by the fact that I was not able to make continuous observations the past year (1909). After comparing with sketches of the abdominal markings, as well as a specimen of each of the winged and wingless viviparous females of *Ch. aceris*, received from Doctor Del Guercio of Italy, I am inclined to consider our species distinct from the European *aceris*, but further study is necessary.[1] First reported by Gillette.

[d] *Ch. candicans* Thos.: Mentioned by Thomas but never described, hence *nomina nuda*.

[t] *Ch. negundinis* Thos.: Oestlund, Bull. Geol. and Nat. Hist. Surv.

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[1] In going over the species of *Chaitophorus*, with a view of monographing the genus, the writer has found many difficulties, necessitating studies continued throughout the year to determine the constancy of the color patterns and measurements. This is especially true of the poplar *Chaitophorus* of which we likely have several undescribed species.

Minn., No. 4 (1887), p. 37; Weed, Insect Life, Vol. 3 (1891), p. 287, figs.; Davis, Ent. News, Vol. 21 (1910), p. 14, figs. Common throughout the state and a pest of considerable importance on box elder. First reported by Thomas.

†*Ch. populicola* Thos.: Sanborn, Kans. Uni. Sci. Bull., Vol. 3 (1904), p. 36, figs. One of our most common species of *Chaitophorus* in Illinois, occurring throughout the state. The several forms (winged male with wings marked as are those of the viviparous female, and oviparous female) are to be found on poplar twigs and leaves in September. First reported by Thomas.

†*Ch. quercicola* Monl.: Bull. U. S. Geol. and Geog. Surv., No. 5 (1879), p. 32; Oestlund, 14th Ann. Rept. Geol. and Nat. Hist. Surv. Minn. (1886), p. 49, (*spinosus*). I took the oviparous forms of this species on the under surfaces of the leaves of post oak (*Quercus obtusiloba*) at Kankakee, Ill., Oct. 13, 1908, and have received winged and wingless viviparous forms from Mr. W. P. Flint, who collected them on white oak (*Q. alba*), at Heyworth, Ill., April 10, 1908. The specimens agree in every particular with the descriptions of *Callipterus quercifolii* Thos. and *Chait. spinosus* Oestl., both of which species I consider synonyms of Monell's *quercicola*. First reported by Monell.

Winged viviparous female.—The following notes are offered to supplement Monell's description.[1] Antennæ with 5–8 sensoria in a row on III; from the alcoholic specimens the coloration appears as follows: I, II, and III, dusky excepting a small pale area a little beyond the center of III. IV and V, pale except the dusky tips, and VI entirely dusky except basal half of base VI. Abdomen with a row of dusky tubercular areas bearing spines on the dorsum, these being most conspicuous at the anterior end; a similar row on each side. Plate 27, figures 1 and 2.

Wingless viviparous female.—The descriptions given by Monell[2] and Oestlund[3] are quite characteristic for the species.

The excellent description of the wingless oviparous female given by Oestlund[4] agrees exceedingly well with my notes and specimens.

**Ch. viminalis* Monl.: Bull. U. S. Geol. and Geog. Surv., No. 5 (1879), p. 31; Weed, Psyche, Vol. 5 (1889), p. 133. Common in all parts of the state on willow. It varies greatly in color,—from a light

[1] Notes on the Aphididæ of the United States, etc. Bull. U. S. Geol. and Geog. Surv., Vol. V, No. 1, p. 32, 1879.

[2] *Loc. cit.*

[3] Synopsis of the Aphididæ of Minn. Bull. 4, Geol. and Nat. Hist. Surv. Minn., p. 38, 1887.

[4] List of the Aphididæ of Minn., etc. 14th Ann. Rept. Geol. and Nat. Hist. Surv. Minn., p. 50, 1886.

brown to almost black, indeed not only the color but the lengths of the antennal segments and numbers of antennal sensoria vary so much that I have been unable to distinguish between this species and Oestlund's *Ch. nigræ*.

* *Callipterus* (*Pterocallis*[1]) *alni* Fabr.: This species is rather common on the lower surface of the leaves of alders in the Chicago parks, and when abundant, as it often is, the upper surfaces of the lower leaves become heavily coated with the honey dew. I believe this species has not before been recorded as occurring in the United States. According to the table of American species of *Callipterus* given by Mr. J. T. Monell,[2] *alni* comes nearest to *C. hyalinus* Monl., from which it may be distinguished by the blackish wing veins, the black tipped cornicles, filament of antennal segment VI shorter than base, etc. Inasmuch as there is no description of this species in American literature, I describe in full the viviparous and sexual forms.

Winged viviparous female.—Head pale greenish yellow, Pl. 27, fig. 3, first thoracic segment pale greenish, thoracic shield pale with a faint brownish tint, and abdomen pale yellowish or greenish yellow with a more or less distinct dorsal transverse green marking near the anterior end, another near the cornicles and a median longitudinal marking, usually indistinct, connecting the two. Antennæ about as long as the body, segment III longest, IV about two-thirds the length of III, V a little shorter than IV, base VI less than one-half the length of V, and filament VI slightly shorter than base VI; 2 to 4 large but rather inconspicuous circular sensoria near the base of III, and the usual ones at the distal ends of segments V and base VI; I and II concolorous with head, III and IV pale (whitish) excepting the distal ends, which are black, V pale at base and gradually darkening to blackish at distal end, VI blackish. (Pl. 27, fig. 4). Eyes red. Beak rather short, reaching a little beyond the coxæ of the first pair of legs. Wings hyaline with rather conspicuous dark brown veins which are apparently bordered with an almost imperceptible pale browning tint, stigma with a dark brown area at each end, stigmal vein hyaline or sub-hyaline except the distal third. (Pl. 27, fig. 5.) Legs pale excepting dusky distal ends of the tibiæ and the blackish tarsi. Cornicles tubercular and black excepting the pale base. (Pl. 27, fig. 6.) Style pale knobbed, anal plate very conspicuously bifid. (Pl. 27, fig. 7.) Measurements,—length of body, 1.4 mm., width, 0.53 mm.; length of wing, 2.2 mm., width, 0.79 mm.; antenna, I, 0.05; II, 0.05; III, 0.4890–0.5460, avg., 0.51; IV, 0.3079–0.3423, avg., 0.33; V, 0.2445–0.2934, avg., 0.27; VI, base 0.1141–0.1304, avg., 0.12; VI, filament, 0.0896–0.1141, avg., 0.0978; avg., total, 1.4278 mm.; cornicles, 0.05–0.06 mm.; styles, 0.115 mm.

Wingless oviparous females.—Head pale greenish yellow, thorax and abdomen pale greenish with darker green dorsal markings as follows: irregular transverse patch near head, another narrower one anterior to the center and a third near the

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[1] For the present I prefer to use the genus *Callipterus* rather than *Pterocallis*. There is every gradation between the two so-called genera. If we take as a criteria the characters for dividing the old genus *Callipterus*, used by several European authors, there would be sufficient reason for the erection of several new genera among the American species of *Callipterus*.

[2] Notes on Aphididæ, Can. Ent., Vol. 14, Jan. 1882, p. 13–16.

cornicles. Eyes red. Antennæ as those of winged viviparous female as to relative lengths of segments and coloration. (Pl. 27, fig. 8.) Beak as in winged, legs also as in winged, excepting the hind femora which are swollen the basal two-thirds and bear many small inconspicuous circular sensoria. (Pl. 27, fig. 9.) Coloration of style and cornicles as given for the viviparous. Abdomen more tapering and drawn out at the posterior end. On the ventral lateral surface just beneath the cornicles is a silvery white patch which proves to be a mass of fine flocculent matter, from glands beneath, and probably is used as a protection for the eggs mentioned below. Measurements (average), length of body, 1.7 mm.; width, 0.8 mm.; antennæ, I, 0.05; II, 0.05; III, 0.38; IV, 0.21; V, 0.19; VI, base, 0.115; filament, 0.098; total, 1.093 mm. Eggs.—They are deposited in the crevices at the buds and are more or less covered with the silvery white flocculent matter found at the glands beneath the cornicles mentioned above. When first deposited they are pale greenish, later changing to jet black.

Winged male.—Head and thorax dark brownish, sometimes prothorax with a greenish tint. Abdomen pale yellowish green, with the green markings similar, but less conspicuous than in the winged viviparous female. Antennæ entirely dusky, 12–14 rather large circular sensoria in a row on III, 5–7 on IV, and 3–5,—together with the usual distal one,—on V, and the usual one at end of VI base. (Pl. 27, fig. 10.) Legs entirely dusky excepting joints and base of femur. Cornicles and eyes and wings as in winged female. Styles dusky. Measurements (average): length of body, 1.2 mm.; width, 0.49 mm.; antenna I, 0.055; II, 0.065; III, 0.46; IV, 0.29; V, 0.25; VI, base, 0.12; VI, filament, 0.105; total, 1.345 mm.

Cal. asclepiadis Monl.: Bull. U. S. Geol. and Geog. Surv., Vol. 5 (1879), p. 29; Oestlund, Bull. Geol. and Nat. Hist. Surv., Minn., No. 4 (1887), p. 42. Found abundant on the common *Asclepias*, throughout the state. First reported by Gillette.

* *Cal. bellus* Walsh: Sanborn, Kans. Uni. Sci. Bull., Vol. 3 (1904), p. 40, figs. Common throughout the state on oak.

Cal. betulæcolens (Fitch) Monl.: Bull. U. S. Geol. and Geog. Surv., Vol. 5 (1879), p. 30; Davis, Annals Ent. Soc. Amer., Vol. 2 (1909), p. 30, figs. Especially abundant on the American and European lindens in the Chicago parks. At Elgin, Ill., this species was exceptionally abundant, the upper surfaces of the linden leaves being coated with honey dew, and the aphids, when disturbed, arose from the leaves in small swarms giving the general impression of a flight of small leaf hoppers, such as *Empoasca mali*. First reported by the writer.

* *Cal. caryæ* Monl.: Bull. U. S. Geol. and Geog. Surv., Vol. 5 (1879), p. 31. A species occurring everywhere throughout the state on hickory and walnut.

† *Cal. caryæfoliæ* Davis: Ento. News, Vol. 21, May (1910), pp. 198–200, 1 pl., 1 fig. First reported by the writer.

* *Callipterus* (*Myzocallis*[1]) *coryli* Goetze: This species has been taken occasionally on the wild and cultivated hazel shrubs, infesting

[1] See note under *Pterocallis* on a preceding page.

the under surfaces of the leaves, in and about Chicago. In Monell's table [1] this species comes nearest to *C. betulæcolens* from which it may be readily distinguished by its smaller size, the pale wing veins, shorter filament in comparison with the base of VI, etc. *C. coryli* was once before reported from the United States, by W. T. Clarke, who collected it in California [2].

Winged viviparous female.—Entire body, including head, (Pl. 28, fig. 11) pale yellow. Antennæ whitish excepting the tips of III, IV, V, distal half of base VI, and filament VI; segment III longest, it being fully a half longer than IV, IV, V, and filament VI subequal, but IV being invariably slightly the longest of the three, VI base being less than half the length of VI filament; three or four large but inconspicuous circular sensoria near the base of III, and the usual ones at the distal ends of V and VI base. (Pl. 28, fig. 12.) Eyes white from above and reddish from below. Beak reaching to the coxæ of the second pair of legs. Legs pale (whitish) excepting the pale dusky distal end of tibia and blackish tarsus. Cornicles concolorous with body; longer than wide but the length less than twice the breadth. (Pl. 28, fig. 14.) Style concolorous with body and knobbed. Anal plate conspicuously bifid. (Pl. 28, fig. 15.) Measurements (average): length of body, 1.1 mm.; width, .046 mm.; length of wing, 1.8 mm.; width, 0.7 mm.; antenna I, 0.055; II, 0.065; III, 0.42; IV, 0.26; V, 0.20; VI, base, 0.105; VI, filament, 0.23; total, 1.335 mm.; cornicles, 0.065 mm.; style, 0.05 mm. Pupa, entirely pale yellow.

Wingless oviparous female.—Entire body pale yellowish. Eyes reddish. Antennæ pale whitish, excepting extreme distal end of III and the remaining segments, which are more or less dusky. Comparative measurements as winged viviparous. (Pl. 28, fig. 16). Legs pale whitish excepting distal end of tibia and the tarsus, which are dusky, hind tibia swollen and bearing rather inconspicuous sensoria on the basal two-thirds. (Pl. 28, fig. 17). Entire body covered with rather long capitate hairs; on the dorsum is a longitudinal row of tubercules, bearing hairs. Abdomen prolonged at the posterior end. Cornicles and style concolorous with the body. Measurements (average): length of body, 1.5 mm.; width, 0.7 mm.; antenna I, 0.05; II, 0.04; III, 0.26; IV, 0.16; V., 0.145; VI, base, 0.09; VI, filament, 0.20; total, 0.945 mm.; cornicles, 0.08 mm.

Winged male.—Head dusky with a faint dark greenish tint; prothorax yellowish with a median longitudinal marking concolorous with head. Thoracic shield shining dark greenish, and abdomen pale yellowish with a median row of short wide transverse black markings and a row of inconspicuous dusky spots on each side. Antennæ as follows: I and II dusky, III pale, and dusky at distal end, the remaining segments dusky to blackish; 17–18 roundish oval irregularly placed sensoria on III, 3–5 in a row on IV, 3-5 on V, and 1-3 on base VI, as well as the usual ones at the distal ends of V and base VI; III longest, it being more than a half longer than IV and about twice the length of VI filament, IV and V subequal, the former being invariably slightly the longer, VI base about one half the length of the filament which is subequal to or slightly less than the length of V. (Pl. 28, fig. 18.) Wing veins slightly darker than the female. Legs pale or slightly dusky, excepting the darker distal end of the tibia and the tarsus. Cornicles and style dusky. Measurements (average): length of body, 1.0 mm.; width, 0.35 mm.; length of wing, 2.25 mm.; width, 0.71 mm.; antenna I, 0.05; II, 0.05; III, 0.42; IV, 0.24; V, 0.215; VI, base, 0.10; VI, filament, 0.215; total, 1.29 mm.

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[1] *Loc. cit.*

[2] A list of California Aphididæ, Can. Ent., Vol. 35 (1903), p. 248.

* *Cal. discolor* Monl.: Oestlund, Bull. Geol. and Nat. Hist. Surv., Minn., No. 4 (1887), p. 41; Weed, Psyche, Vol. 4, (1889) p. 131. A common species on the oaks (*Quercus* spp.).

Cal. hyperici Monl.: Bull. U. S. Geol. and Geog. Surv., Vol. 5 (1879), p. 25 (*Aphis*). First reported by Thomas.

* *Cal. punctatus* Monl.: Bull. U. S. Geol. and Geog. Surv., Vol. 5 (1879), p. 30. Not uncommon in Illinois on oak.

Cal. trifolii Monl.: Davis, Annals Ent. Soc. Amer., Vol. 1 (1908), p. 256, figs. A common species on clover, but of little economic significance. First reported by the writer.

Cal. ulmifolii Monl.: Bull. U. S. Geol. and Geog. Surv., Vol. 5 (1879), p. 29; Oestlund, Bull. Geol. and Nat. Hist. Surv. Minn., No. 4 (1887), p. 42. Abundant on *Ulmus americana* throughout the year, the sexual forms (winged male and wingless female), being common in September and October. Although not usually considered injurious to the elm, I have occasionally found them sufficiently common to do injury, causing the foliage to drop prematurely and coating the upper surfaces of the leaves with honey dew. First reported by Gillette.

† *Calaphis betulella* Walsh: Proc. Ent. Soc. Phila., Vol. 1 (1862), p. 301. I have never taken this interesting species, but Walsh reported it from Illinois in his original description. Mr. J. T. Monell has kindly sent me specimens collected by him at St. Louis, Mo., on the leaves of birch. Camera lucida drawings of the head, wing, cornicles, and style are given in Plate 28, figures 19 to 23.

* *Monellia caryella* Fitch: Oestlund, Bull. Geol. and Nat. Hist. Surv. Minn., No. 4 (1887), p. 45. I have collected this species but once, namely on hickory at Centralia, Ill., August 13, 1907.

Drepanaphis acerifolii Thos.: Sanborn, Kans. Uni. Sci. Bull., Vol. 3, No. 1 (1904), p. 45, figs. Common throughout the state on soft maple and occasionally on hard and Norway maple but seldom in such numbers as to be injurious. The winged males and wingless females are quite common in September; the eggs being deposited in the crevices at the buds, or cracks of the rough bark of the smaller branches. First reported by Thomas.

† *Drepanaphis? minutus* Davis: Ento. News, Vol. 21 (May 1910), pp. 195–198, 1 pl. First reported by the writer.

† *Idiopterus nephrelepidis* Davis: Annals Ent. Soc. Amer., Vol. 2 (1909), p. 199, figs. Occasionally found in Chicago greenhouses attacking the tender unfolding fronds of the Boston and other ferns. It sometimes becomes abundant and destructive in poorly kept greenhouses, but where fumigation is regularly practiced they are easily held in check. First reported by the writer.

(*To be continued*)

Explanation of Plates 27 and 28.

Chaitophorus quercicola Monl.—Fig. 1, wing; 2, antenna of winged viviparous female.

Callipterous alni Fabr.—Fig. 3, head; 4, antenna; 5, wing; 6, cornicle; 7, style of winged viviparous female; 8, antenna; 9, hind tibia of wingless oviparous female; 10, antenna of winged male.

Callipterus coryli Goetze.—Fig. 11, head; 12, antenna; 13, wing; 14, cornicle; 15, style of winged viviparous female; 16, antenna; 17, hind tibia of wingless oviparous female; 18, antenna of winged male.

Calaphis betulella Walsh.—Fig. 19, head; 20, antenna; 21, wing; 22, cornicle; 23, style of winged viviparous female.

Camera lucida drawings, figures 3, 6, 7, 11, 14, 15, 19, 22, and 23 with one-inch eye piece and two-third objective; 2, 4, 8, 9, 10, 12, 13, 16, 17, and 18, with two-inch eye piece and two-third objective; 1, 5, 20, and 21, with one-inch eye piece and one and a half-inch objective.

THE COCCIDÆ OF AUDUBON PARK, NEW ORLEANS, LA.[1]

First Paper

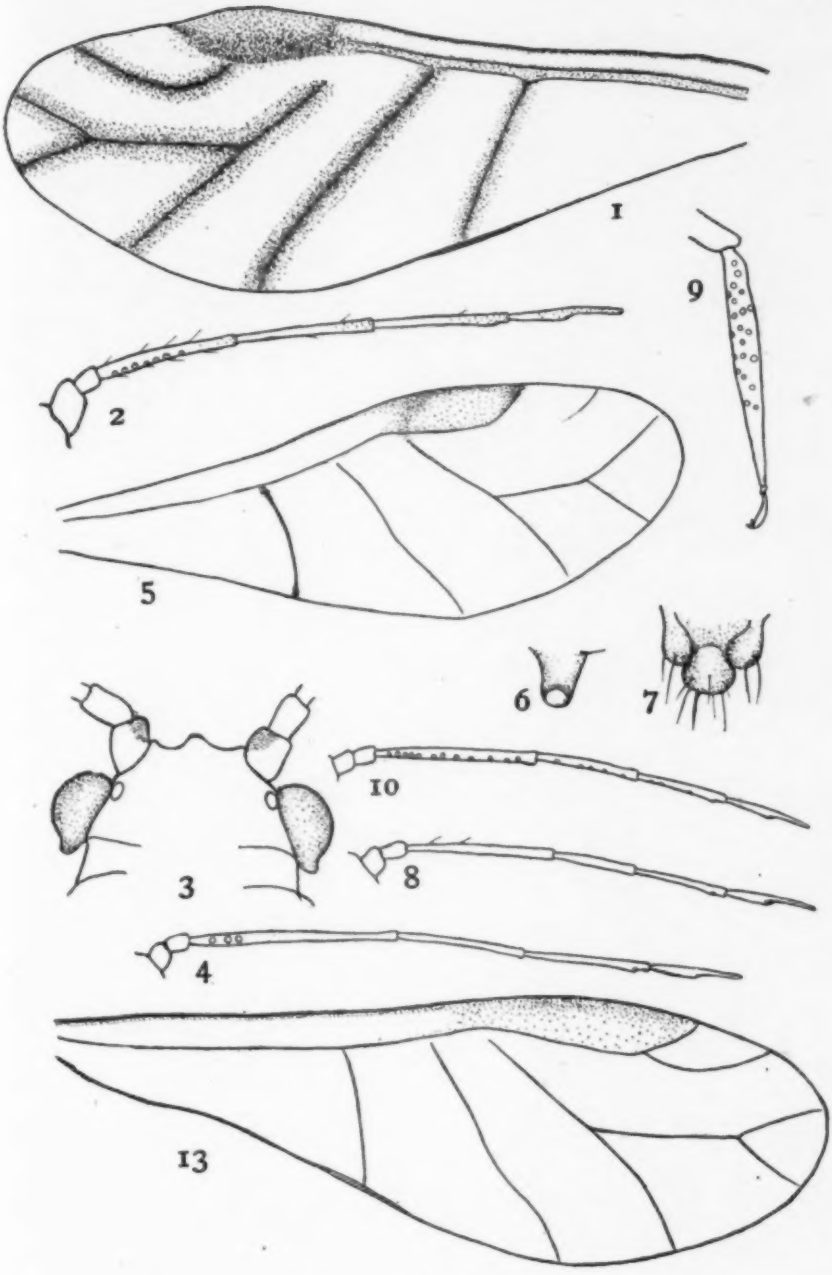
By T. C. Barber, *Audubon Park Laboratory, Agent and Expert, U. S. Bureau of Entomology*

Audubon Park, New Orleans, is a particularly favorable locality for the development of plant and insect life. The climatic conditions are such that plants seem to thrive with equal facility whether they are transported from regions far to the north of Louisiana, or from as far to the south. Scattered through the park may be found representatives of almost all the common ornamental plants of the Northern States, while flourishing side by side with them can be seen hundreds of plants representing the native semi-hardy flora and plants imported from the semi-tropical regions of Mexico and Cuba. In one corner of the park may be found the huge Horticultural Hall, a relic of the Cotton Centennial Exposition of 1884. In this hall hundreds of species of tropical plants are found, which are carried through the comparative coldness of the Louisiana winters by means of artificial heat. Altogether, it is doubtful if many places can be mentioned where the observer is confronted by such a luxuriant and varied array of flora in a circumscribed area as can be found in this piece of land of less than 300 acres within the city of New Orleans.

The same conditions which make possible this diversity of plant growth, also make this spot an ideal one for insect development. With the exception of a few weeks of moderately cool weather in the winter, insect growth and multiplication is practically continuous the

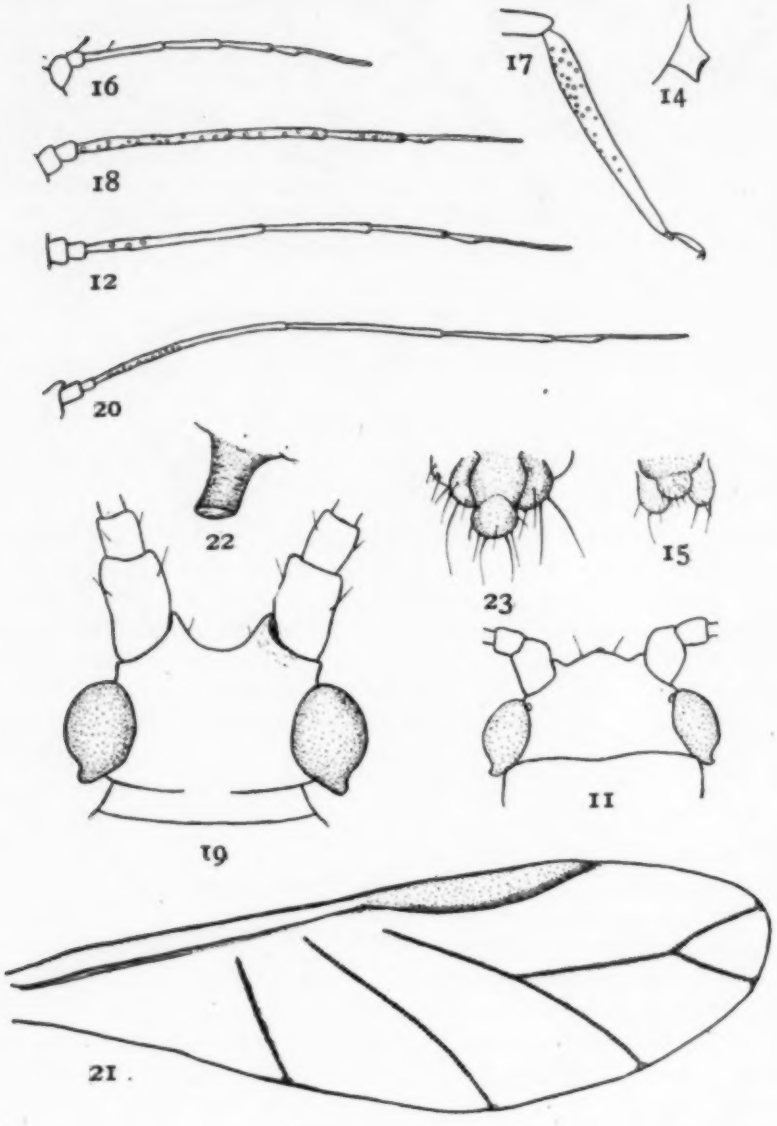
[1]Published by permission of the Chief of the Bureau of Entomology.

Plate 27



Structure of Aphididæ

Plate 28



Structure of Aphididæ

year round. The wide range of food offered by the large variety of plants, the humidity of the atmosphere, which tends to keep conditions at an optimum for both plant and insect growth, the small annual range of temperature, all result in the production of a large and varied insect fauna.

This is especially the case with the Coccidæ. These insects are for the most part so small and inconspicuous that they are easily introduced when importing foreign plants of every description. With the number of plants which have been imported into Audubon Park it would naturally be expected that a large number of scale insects would have been introduced with them, and this expectation is realized when one comes to examine the plants closely. Almost all the plants reveal the presence of one or more scale insects, and some of them can be found burdened with four or five species. Of course many of these scale insects are identical, that is, the same scale is often found on a large variety of plants, but even then, an unusually varied assortment may be noticed.

The excretions of scale insects and aphids form the chief food of the Argentine ant (*Iridomyrmex humilis* Mayr.) in the parks and squares where large numbers of plants abound, and the attention of the writer was first called to the number and variety of coccids by the vast numbers of these ants which can be seen assiduously attending them. The following list represents the more common species, but this can no doubt be added to extensively by going over the flora of the park more carefully and systematically than the writer has been enabled to do with the time at his disposal.

The species are arranged on the system followed by Mrs. Fernald in her "Catalogue of Coccidæ." The plants upon which they were collected are given a common name, as far as possible, but when no common name could be found, or where the use of the local common name would tend to cause confusion with different plants bearing the same common name in other localities, the scientific name is given.

The writer is deeply indebted to Messrs. J. G. Sanders and E. R. Sasscer of the Bureau of Entomology, for determinations of the large amount of material submitted to them through Dr. L. O. Howard at various times.

List of Coccidæ Collected at Audubon Park, New Orleans, La.

1. *Conchaspis angræci* Ckll. Collected upon *Icalpha miltoniana*, *Hibiscus sinensis*, *Acalypha sanderi*.

2. *Lecaniodiaspis* sp. Collected upon the fig.

3. *Pseudococcus adonidum* L. Collected upon coffee tree (*Coffea arabica*), jasmine, rubber tree (*Ficus elastica*), *Phyllanthus distiachus*, guava (*Psidium pomiferum*).

4. *Pseudococcus calceolariæ.* Mask. Collected upon the sugar cane, Johnson grass.

5. *Pseudococcus citri* Risso. Collected upon Croton, fig, orange, trumpet-vine (*Datura arborea*).

6. *Pseudococcus* sp. Collected upon hickory.

7. *Pseudococcus* sp. Collected upon Jamaica apple (*Anona cherimloa*).

8. *Pulvinaria cupaniæ* Ckll. Collected upon *Cupania sapida*, Calabash tree (*Crescentia cujetes*).

9. *Pulvinaria vitis* Al. Collected upon persimmon.

10. *Ceroplastes cirripediformis* Comst. Collected upon persimmon.

11. *Eucalymnatus tessellatus* Ckll. Collected upon *Caryota urens*, royal palm (*Oreodoxia regia*), *Wallichia caryatifolia, Rhapis variegatus, Phœnix* sp., rattan palm.

12. *Coccus hesperidum* L. Collected upon alligator pear (*Persea gratissima*), guava (*Psidium pomiferum*), *Malpighia glabra*, melon papaw (*Carica papaya*), banana, (*Musa cavendishi*), *Camellia japonica*, coral tree (*Erythrina cristi-galli*), cocoa tree (*Theobroma cacao*), Jamaica apple (*Anona cherimloa*), poinsettia, orange, *Ficus* sp., English myrtle.

13. *Neolecanium cornuparvum* Thro. Collected upon *Magnolia grandiflora, Magnolia fuscata.*

14. *Eulecanium corni* Bouche. Collected upon persimmon, swamp cypress.

15. *Eulecanium* sp. Collected upon sycamore.

16. *Saissetia hemisphærica* Targ. Collected upon coffee tree (*Coffea arabica*).

17. *Saissetia oleæ* Bern. Collected upon coral tree (*Erythrina cristi-galli*), golden dew-drop (*Duranta plumieri*).

18. *Diaspis bromeliæ* Kern. On pineapple.

19. *Diaspis boisduvalii* Sign. On *Phœnix reclinata.*

20. *Aspidiotus camelliæ* Sign. On *Magnolia grandiflora, Magnolia fuscata*, coral tree (*Erythrina cristi-galli*), evergreen thorn (*Cratægus pyracantha*), *Aralia paperifera*, China-berry, fig.

21. *Chrysomphalus dictyospermi* Morg. On *Rhapidophylum hystrix.*

22. *Aspidiotus hederæ* Vall. On sago palm.

23. *Aspidiotus lantaniæ* Sign. On alligator pear (*Persea gratissima*), guava (*Psidium pomiferum*), Loquat (*Photina japonica*), mulberry, asparagus vine, prickly palm (*Agrocomia mexicana*), juniper.

24. *Aspidiotus perniciosus* Comst. On pear tree.

25. *Cryptophyllaspis liquidambaris* Kot. On sweet gum tree.

26. *Chrysomphalus aonidum* Linn. The most abundant scale in the park. Some of the plants it was collected upon were banana (*Musa*

cavendishi), *Aralia chabrierii*, *Magnolia grandiflora*, orange, sweet olive, camphor tree, oleander, royal palm (*Oreodoxia regia*), date palm (*Phœnix reclinata*), prickly palm, (*Agrocomia mexicana*) screw pine, cocoanut palm, *Phœnix canariensis*, *Chamerops gracilis*, *Metrosideros* sp., *Aralia paperiferæ*, poinsettia, myrtle, etc.

27. *Chrysomphalus obscurus* Comst. On pecan.

28. *Odonaspis inusitata* Green. On bamboo (*Bambusa argentia striata*), Japanese bamboo (*Bambusa taisan chiku*).

29. *Odonaspis* sp. On Bermuda grass.

30. *Lepidosaphes beckii* Newn. On orange, *Citrus trifoliata*, *Camellia japonica*.

31. *Lepidosaphes gloverii* Pack. On orange.

32. *Ischnaspis longirostris* Sign. On *Elæis guineensis*.

33. *Parlatoria pergandei* Comst. On Croton, orange.

34. *Parlatoria proteus* Curt. On *Elæis guineensis*.

THE COCCIDÆ OF BOULDER COUNTY, COLORADO

By T. D. A. Cockerell

In the *University of Colorado Studies*, Feb., 1905, I published tables for the separation of all the Rocky Mountain Coccidæ known at that time. Not many have been added since, but we have now a fair list of species from Boulder County, which seems worth publishing. I have included in the list (marked with an asterisk), various species brought in with plants, and not in any sense members of the fauna. These are of interest as showing the way in which Coccidæ are carried about, and also as indicating sources of interesting material to those engaged in the study of the group.

Ortheziinæ

Orthezia lasiorum Ckll. and *O. olivacea* Ckll. Both common at Boulder in nests of *Lasius*.

I will take this opportunity to raise once again the question whether the *Coccus adonidum* L. is not an *Orthezia*. I so referred it in Proc. Phila. Acad., 1899, but Marchal (Ann. Soc. Ent. France, 1908, p. 226) considers it to be *Pseudococcus*, while actually quoting the description, in which appears the words, "*linea dorsalis longitudinalis elevata.*" Sanders, (Jour. Econ. Ent., 1909, p. 431) reaching the same conclusion as Marchal, or merely following him, even refers to the "good" Linnean description. As I had already said my say, I tried, but without success, to get a committee of entomologists to sit on this

question, which is of importance as affecting the name of a common pest. Could the Associatioh of Economic Entomologists take it up?

MONOPHLEBINÆ

**Palæococcus rosæ* Riley and Howard. On a bunch of bananas in a grocery store in Boulder.

DACTYLOPIINÆ

Dactylopius confusus Ckll. Common on *Opuntia* at Boulder. Also at Salina.

Ceroputo lasiorum Ckll. Boulder, in nests of *Lasius*.

Phenacoccus cockerelli King. Boulder, found by Mr. L. C. Bragg on wild *Prunus*. The following measurements from this material are in microns: Antennal segments (1) 27, (2) 50, (3) 42, (4) 30, (5) 40, (6) 32, (7) 27, (8) 27, (9) 52. Middle leg; femur with trochanter, 195; tibia, 120; tarsus (without claw), 85.

Pseudococcus gutierreziæ Ckll. Boulder, on *Gutierrezia*.

P. roseotinctus T. and W. Ckll. Variety with third antennal joint longer than usual. Boulder, with *Lasius*, May, 1907.

Erium lichtensioides Ckll. Boulder, abundant on *Artemisia*. Also at Salina.

Trionymus nanus Ckll. Described from Boulder.

Ripersiella leucosoma Ckll. Boulder.

Ripersia fimbriatula Ckll. and King, *R. salmonacea* Ckll., *R. viridula* Ckll., and *R. confusella* Ckll. Boulder, with *Lasius*. The following notes were made on the male of *R. confusella*, variety, collected on Flagstaff Hill, March 28, 1910, with *Lasius americanus* (T. and W. Ckll.).

Male. Pale pink, eyes dark red; mesothorax darker than head and prothorax, no dark bands; legs rather dark; four long white caudal filaments, the outer much shorter than the inner; head seen from above obtusely triangular, widest behind the eyes; length of wing, 1326 μ.

The accompanying female was pale pink, elongate, with no evident lateral tassels; caudal bristles about 120 μ. It appeared to be in the penultimate stage.

COCCINÆ

I follow the Fernald Catalogue as to *Coccus*, but it is possible that a different interpretation may hold. At all events, the name *Coccus* should properly have been restricted to what we now call *Kermes*, following the plan of selecting the best-known *native, economic* species. Moreover *Coccus* is the ancient name of *Kermes*.

Physokermes concolor Coleman. On *Abies lasiocarpa*, Lake Eldora,

Fig. 1.

Fig. 2.

Fig. 3.

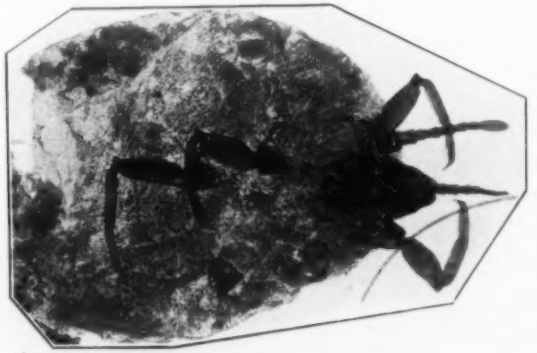


Fig. 4.

Structure of Coccidæ.

July 25, 1910 (E. Bethel). Smaller than *P. coloradensis*, the transverse diameter 5 mm. or less, color light fulvous brown. Coleman's description of his Californian insect on *Abies concolor* is too short, but doubtless our species is the same. *P. coloradensis* is probably confined to *Picea*.

**Eucalymnatus tessellatus* Sign. On a hothouse palm, Boulder.

Pulvinaria bigeloviæ Ckll. On *Chrysothamnus*, Boulder, June, 1910 (E. Bethel).

Eriopeltis coloradensis Ckll. Boulder is the type locality.

DIASPINÆ.

**Diaspis boisduvalii* Signoret. Boulder, on ferns in greenhouse.

Chionaspis pinifoliæ Fitch. Boulder canon, 7340 ft. on *Pinus scopulorum*. Also on Flagstaff Hill and at Salina.

Chionaspis bruneri Ckll. Boulder, on *Populus*. Preyed upon by *Chilocorus bivulnerus*. I use the name *bruneri* instead of *salicis-nigræ* (Walsh), because Walsh's species was never recognizably described, and the application of his name to the present insect is mere guesswork.

**Hemichionaspis aspidistræ* Signoret. Boulder, on ferns in greenhouse.

Targionia graminella Ckll. On *Bouteloua oligostachya*. Found by Mr. E. Bethel at Boulder, and also at Leyden and Trinidad, Colorado. This species was discovered in New Mexico, and was considered extremely rare, but Mr. Bethel has found it abundant and destructive.

**Chrysomphalus aonidum* L. Boulder, on *Ficus* and palms in greenhouse.

**Aspidiotus hederæ* Vallot. Boulder, on trailing *Asparagus* indoors (Miss Olive Jones).

Aspidiotus ancylus Putnam. Boulder, on apple (D. B. Thurston).

A. juglans-regiae Comst., var. A few scales on the bark of a branch of wild plum, brought in for the *Phenacoccus*; Boulder, June, 1910 (Bragg). The material is scanty, and perhaps not quite typical.

**A. perniciosus* Comst. On Japanese quince shipped in, but not planted out, Nov. 1908 (T. B. Holman).

Explanation of Plate 29

Fig. 1. *Trionymus nanus* Ckll. on roots of grass under a stone. Boulder, Col., November, 1904.

Fig. 2. *Ceroputo lasiorum* Ckll. in nest of *Lasius interjectus*. Las Vegas, New Mexico, April, 1901.

Fig. 3. *Orthezia olivacea* Ckll. in nest of *Lasius* sp. Boulder, Col.

Fig. 4. *Orthezia lasiorum* Ckll. in the nest of *Lasius americanus*. Las Vegas, New Mexico, April 25, 1910.

Photographs from type slides kindly made for me at the Bureau of Entomology.

Appendix

Since the above paper was sent in, Mr. E. Bethel has sent me pieces of *Betula glandulosa* collected at Tolland on Aug. 26, plentifully infested with *Pulvinaria* and *Eriococcus*. Tolland is at an altitude of 8890 ft., which is very high for coccids; and while it is not in Boulder County, it is only a few miles south of the line.

The *Eriococcus* is unfortunately represented only by males, but the species is probably *E. borealis* Ckll., the only one known to occur at high altitudes. The *Pulvinaria* is represented by adults of both sexes, and is a very puzzling form of the *P. vitis* group. Provisionally I regard it as a variety of *P. occidentalis* Ckll.

Pulvinaria occidentalis var. *subalpina* n. var.

♀ Resembling *P. innumerabilis*, with the same sort of ovisac; scale very dark brown, hard to clear, 6.5 mm. long, 5.5 broad; marginal bristles 22–30 μ long, much more distant from one another than the length of one. Anterior tibia 180 μ, its tarsus (without claw) 85; claw stout, strongly curved; tarsal digitules quite stout, 55 μ long; claw digitules with large knobs, about 7 μ diameter. Antennæ 8-jointed, joints measuring in μ (1)67; (2) 67; (3) 100–102; (4) 67–75; (5) 67; (6) 35–40; (7) 30–32; (8) 57. Hair on first joint not very long; second with two bristles, one very long, fully 112 μ; third with one bristle, not very long; fifth with a very long bristle, 105 μ; sixth and seventh each with a short bristle; eighth with many, none very long. The immature female scales have a certain amount of thin glassy secretion on the dorsal surface.

♂ Head and mesothorax black (brown by transmitted light); neck reddish; prothorax dark red; abdomen dark reddish; legs and antennæ brown. Length about 1700 μ, excluding caudal filaments, which are about 1100 μ, and stylus, which is 405 μ; head small, 270 μ wide; wings 1530 μ long and 760 wide; anterior tibia 440 μ, its tarsus 200.

The glassy white male puparium, 2 mm. long, is as in *P. ribesiæ*, except that the posterior transverse lines or bands are continuous across the dorsum.

This male, compared with that of *P. ribesiæ*, as beautifully figured by Newstead, is seen to have the same coloration, but the caudal filaments are much shorter, and the anterior tibiæ are longer. In *subalpina* the fourth antennal joint (220 μ) is much longer than the fifth (150 μ), while in *ribesiæ* they are not far from equal. For the male of *P. vitis*, we have Signoret's figures. According to these *P. vitis* has the caudal filaments very long, as in *ribesiæ*, the fourth antennal joint also about as in *ribesiæ*, but the anterior tibia long as in *subalpina*.

P. innumerabilis male, as figured by Howard, has the caudal filaments relatively short, as in *subalpina*, but the fourth and fifth antennal joints are about equal and the tibiæ are rather short.

The female of *subalpina* seems to be distinguished by the relatively short tarsus and certain features of the antennæ. The hairs on the antennæ are practically as in *P. vitis* (as figured by Newstead), except

that those on the last joint are shorter, none longer than the joint itself. The antennal curve (based on the lengths of the joints) is nearly as in *occidentalis*, *ehrhorni* and *cockerelli*, but is not like *innumerabilis*, the third and fifth joints being much longer. (For *innumerabilis* I have two composite curves, based on 15 and 9 antennæ respectively, measured by King.)

I supposed at first that my insect would prove to be *P. innumerabilis betheli* King, [1] described from Colorado, and at first stated to be from *Betula*, but really from *Alnus*. This *betheli* form, however, really seems to be *innumerabilis*, and at any rate its special characters are not found in *subalpina*.

P. vitis verrucosæ King, found at Hamburg on *Betula verrucosa*, has the last antennal joint shorter, marginal hairs 40 μ, tibia 188 μ, and tarsus 96 (data from King). It does not appear to be our species. Mr. J. G. Sanders (Journ. Econ. Ent., Dec. 1909) has stated that *P. vitis*, *occidentalis* and *innumerabilis* are all one species. There is no doubt that his illuminating experiments throw much light on the variability of *P. innumerabilis*, and its adaptability to different plants. Indications of all this had been given by other writers, especially King (Psyche, May 1901), and it must doubtless be admitted that we have too many names in this group. Newstead treats *P. ribesiæ* as a variety of *vitis*, but nevertheless when he made experiments similar to those of Mr. Sanders, transferring the insects to twenty different plants, he met with no success, although the larvæ were seen to hatch. It thus appears that in the *P. vitis* groups there exist one or more very polyphagous species, and others which are virtually confined to one type of plant. The monophagous forms should no doubt be classed as true species, although they may very closely resemble the common widespread *vitis* or *innumerabilis*. As to the identity of *P. vitis* with *innumerabilis* and *occidentalis*, I am far from positively asserting that Mr. Sanders is wrong; but if he has data proving it, he he has not yet published them, and until he does so I am wholly unwilling to accept his dictum as final. Apparently these things have small but real distinctive characters, and I fear that in these and other instances there will be a tendency to "lump" uncritically, partly because it saves much trouble, and partly as a reaction against too much "splitting."

P. innumerabilis is common in Denver. If all the insects now discussed are one species, it is just possible that the eggs or larvæ were brought to Tolland by a bird, a distance of about 30 miles. I can hardly doubt, however, that *subalpina* is native, and if not a form

[1] *Pulvinaria innumerabilis betheli:* was described from "Colorado." I learn from Mr. Bethel that it was obtained on *Alnus tenuifolia* at Grand Lake, Middle Park.

of the northwestern *occidentalis* (surely not, if *occidentalis* is really to be united with *vitis*), then a distinct species. I use a varietal name here, as I have in many other cases, to indicate a form the taxonomic position of which is uncertain.

LIFE HISTORY NOTES AND CONTROL OF THE COMMON ORCHARD MITES TETRANYCHUS BIMACULATUS AND BRYOBIA PRATENSIS

By G. P. WELDON, *Grand Junction, Colorado*

Little is known about the wintering habits of the various species of mites belonging to the genus Tetranychus. It may be of interest to some of the readers of the JOURNAL OF ECONOMIC ENTOMOLOGY, if in this article a brief account is given of the hibernation of one of the more common species found in Colorado.

During the summer seasons of 1908, 1909 and 1910, *T. bimaculatus* has been of general occurrence throughout the orchard sections of the Western Slope of Colorado, and in many cases their numbers have become so abundant and their attacks so severe, that considerable injury to trees and fruit has been the result.

HIBERNATION OF T. BIMACULATUS.—In the spring of 1908 a number of apple trees were banded with " tree tanglefoot " to trap the woolly aphis as it migrated from the roots to the branches of the trees. On April 27, quite a number of the above species of mite were found in the lower margin of a band, which indicated that they had hibernated in the soil close to the tree. During the early fall of the same year, Mr. O. B. Whipple, who was at that time Field Horticulturist of the Colorado Experiment Station, at Grand Junction, sent me some red mites of this species for identification, which he had collected on the ground where they had migrated in abundance from some peach trees, upon the foliage of which they had been feeding. During the summer of 1909, *T. bimaculatus* was very plentiful on orchard trees at Palisade, Colo., and I had an opportunity of observing the same thing. On August 9, the mites were found to be leaving the trees in great numbers. There were so many of them that the ground was literally red in places, and their silvery webs were everywhere to be seen. An examination of clods of earth in the orchard, showed that the mites had sought shelter beneath them, and they were found going into the soil at distances up to fully eight feet from the nearest tree. Upon breaking open small clods hundreds of the mites would often be found within. Webs were found in the little soil spaces, and a careful search

for eggs was made. The search resulted in not finding a single one. A large abundance plum tree, at the base of which myriads of the mites entered the soil in August, served as an observation place until October, when the work ceased until spring. On the 23rd of March the tree was again visited, and an examination of the soil near the crown was made for mites which it was thought had surely hibernated there over winter. Clod after clod was broken, myriads of the dead mites were found, and the search became discouraging. Finally a clod which was quite moist, and which had probably retained its moisture all winter, was broken into, and there in a tiny soil cavity was a nest of only half a dozen lively little red mites, which had survived through severe winter weather, at a depth of 1.25 inches beneath the surface of the soil. The striking fact that where millions had entered the soil in the fall, only a very few individuals survived, was attested by the tremendous lot of dead ones encountered during the search, and only a half dozen live ones. Truly it was a case of the survival of the fittest.

Summer Habits of T. bimaculatus.—This is the only species of *Tetranychus* that I have found feeding upon orchard trees. The close association of this species with *Bryobia pratensis* has made it very difficult for the orchardists to distinguish the one species from the other. *T. bimaculatus* has been commonly found in the orchards on apple, plum, prune, peach, pear, cherry and almond trees. Most of our shade trees seem subject to their attack, and small fruits are quite often severely injured. Especially have they been abundant on raspberry bushes, and some of the raspberry growers have attributed not only the failure of their fruit crop, but also the death of many bushes to the attack of this little pest.

The season during which this pest becomes serious is fortunately short. It is seldom that their injury becomes great until the hot weather of July, and while a few commence work quite early in the season, it is not usual to see them in great numbers until the excessive heat of midsummer accelerates their development. Often the orchardist is hardly aware of their presence until the latter part of July, when he suddenly notices the foliage of his trees turning yellow, and at this time he may also witness a wholesale migration of the little red pests to the ground, where every clod turned over reveals the hiding place for hundreds of them. Slowly they make their way into the soil to a depth of presumably never more than two inches, where conditions will probably be favorable for at least a few of them to survive the winter. On the 26th of July this season, the first downward migration of mites was noticed in two orchards near Grand Junction, and the soil for several feet on every side of infested trees was alive with them.

During the time that the mites are feeding on the foliage of trees, they are green in color, with dark colored spots plainly showing on the dorsum. As soon as feeding ceases the color almost immediately changes to some shade of orange, or red. The first mites found migrating to the ground this season, were a light orange color, with one large dark spot in the center of the dorsal surface of the body. When kept in a small box for a few days these gradually became more red in color, and all trace of the dark spots disappeared. The dark spots are undoubtedly due to the body contents of the mites, and the red color seems to be an indication that feeding has ceased. This is true at least, for the mites that feed upon orchard trees.

CONTROL OF T. BIMACULATUS.—Occasionally it becomes necessary to fight this pest by means of a spray, and we have found nothing better than sulphur, which may be either dusted on the trees, or applied with water as a liquid spray. I have had splendid success in treating trees for this red spider, with one pound of sulphur in from three to five gallons of water, the weaker mixture being apparently just as effective as the stronger. A small amount of soap used in the water, will cause the sulphur to settle to the bottom of the spray barrel or tank, and a good agitator will keep it stirred up in fairly good shape, so that a thorough application may be made with any of the ordinary nozzles. It is important that the sulphur be finely screened so that all lumps may be taken out before using. Lime and sulphur applied in the early spring while the trees are dormant, has not proven a successful spray for *T. bimaculatus*. A great many orchards treated with lime and sulphur in the spring, have been observed this summer, and while *Bryobia pratensis* has been practically exterminated in all orchards where such a spray was used, *Tetranychus bimaculatus* has later appeared abundantly.

The tiny black lady-bird beetle, *Scymnus punctum*, is quite commonly found feeding on red spiders, but nowhere has it been found plentiful enough to be of much service in their control.

WINTERING OF BRYOBIA PRATENSIS.—This species of mite is commonly found in the egg stage during the winter season. Occasionally, however, they have been found in houses where the adults hibernate, causing more or less inconvenience to the house-wife. Their tiny red eggs are very commonly found on almond, pear, plum, prune, cherry, apple and peach trees.

SUMMER HABITS OF B. PRATENSIS.—The injury to trees from *B. pratensis* is quite similar to the injury from *T. bimaculatus*. The absence of webs often makes it more difficult to detect this species. The same varieties of trees were found infested with the brown mite that were found infested with the red spider. There seems to be a

distinct differentiation of the broods of *B. pratensis*, and while it is quite a difficult matter to determine definitely this point, the fact that at certain times practically all the mites in a certain orchard will be adult, while at other times only the little red, six-legged nymphs, or only the eggs will be seen in any numbers, would seem to indicate that there is a more or less distinct separation of broods.

This species of mite often deposits the eggs, which remain on the trees all winter, before the first of August, and after that time scarcely any mites can be found, and no injury need be expected from them for the rest of the season.

CONTROL OF B. PRATENSIS.—The control of this mite is quite a simple matter. Unlike *T. bimaculatus*, which is not effectively controlled by a dormant spray of lime and sulphur, this species is controlled perfectly by such a spray. Many orchards which contained a large number of eggs of this mite, both unsprayed and sprayed with lime and sulphur, have been under observation since the time of spraying in April, to the present date, August 4. In no case have lime and sulphur-sprayed trees been found even moderately infested with this species of mite. At most, only a very few individuals have been seen upon sprayed trees. Three peach orchards, one not treated with lime and sulphur, and adjoining orchards on two sides each sprayed with " Rex " solution, were found to contain eggs in abundance, and each was closely watched while the eggs were hatching so that the effect of the lime and sulphur might be determined. It was found that the eggs hatched upon both the treated and untreated trees. On the former the mites would die in a short time after hatching from the eggs, while on the latter development was unchecked. As a consequence the unsprayed orchard soon had quite a severe infestation of mites, while the two treated orchards have been entirely free from them all season.

When orchards have not been treated with a dormant spray of lime and sulphur it is often necessary to use a summer spray, and again sulphur seems to be more effective than anything else. It was found that only a few of the adult mites were killed by the sulphur, but that the tiny larvæ were destroyed as soon as they hatched from the eggs. Consequently after the sulphur treatment, many adult mites may be seen on the trees for a few days; for example, some pear trees sprayed on July 1st, with sulphur, using 1 pound to 5 gallons of water, were examined on July 5th, and many adult mites were found on the foliage. On July 8th, not a single adult could be seen, and with the exception of an occasional newly hatched mite the trees were free from them. Last season's experiments revealed the same facts in regard to the sulphur treatment for mites, and in those states where trouble

from these pests demands that something must be done to check their onslaught, either a dormant spray of lime and sulphur, or a summer treatment with flowers of sulphur will probably be found perfectly effective.

NOTES OF THE SEASON IN CONNECTICUT.

By W. E. Britton

The prevalence or absence of the various insect pests and their natural enemies varies greatly from year to year, and though observations regarding them may not possess great scientific value, nevertheless such records should be kept when possible, and if published in a periodical like the Journal, will show something of interest and value in the progress of the distribution of certain species and their fluctuation, or periods of serious injury and subsequent decline.

Aphids, which were generally abundant last year, have been comparatively scarce during the present season. Of course, some kinds are always present, but the rosy apple aphis, which did such serious damage in 1909, was almost wholly absent in 1910, and in some orchards much searching was necessary to find a single colony. In no instance did a case of injury from it come to my notice. Eggs of the 15-spotted lady beetle, *Anatis* 15-*punctata* Oliv., were extremely abundant on the trunks and branches of apple trees early in May, fifteen to twenty clusters containing altogether several hundred eggs, being often found on a single tree. It may therefore be assumed that this Coccinellid played a rôle of no mean importance in checking the depredations of the rosy apple aphis, but it was not the only natural enemy, as many of the aphids were parasitized late in 1909 by *Megorismus fletcheri* Cwfd., and syrphid and *Chrysopa* larvæ were abundant. The green apple aphis, *A. pomi* De G., was present both seasons in moderate numbers.

White grubs were destructive to grass lands in 1909, and June beetles were abundant early the following season, even defoliating trees in some sections of the state. Rose beetles were present in usual numbers, and caused the ordinary amount of damage in gardens and vineyards.

One characteristic of 1910 is the scarcity of sphinx larvæ, and nearly all those observed were strongly parasitized. Especially has this been true of the common tomato or tobacco worms, *Phlegethontius sexta* Johan. and *P. quinquemaculata* Linn, every caterpillar which we have taken showing before pupation the cocoons of *Apanteles congregatus* Say.

Canker worms, chiefly the fall species *Alsophila pometaria* Harr., were abundant, and their devastation was widespread throughout the state on many different kinds of trees.

Cut worms were especially troublesome in June, and much damage was reported to this office.

Sawfly larvæ of several unusual kinds were observed feeding upon plants not commonly attacked. The peach sawfly, *Pamphilius persicum* MacG., defoliated many trees in some of the large peach orchards, and though I have not learned of any attempt to check their ravages by spraying, some of the orchardists are now planning to spray their trees in 1911 with lead arsenate to prevent a repetition of the injury.

The result of the campaign against the gypsy moth colony at Wallingford has been most satisfactory, and through the efficacy of lead arsenate spraying and of tanglefoot and burlap bands the number of caterpillars was so greatly reduced that before the end of the season the combined efforts of a gang of fifteen men resulted in finding only a few examples during a week of careful searching. At the Stonington infestation good progress was also made, and though more caterpillars were taken than in 1909, the whole number might have been produced by a single egg-mass overlooked in scouting during the winter.

The brown-tail moth, *Euproctis chrysorrhœa* Linn., which has hitherto not appeared in Connecticut except on nursery stock imported from Europe, was found at Thompson in April, 1910, by some men who were engaged in pruning trees on a large estate. We sent men to the vicinity to investigate, and seven or eight pear and apple trees were found infested, and were at once sprayed with lead arsenate. Later some nearly full-grown caterpillars were discovered at Putnam. Both of these towns are in the northeast corner of the state, and the infestation is no doubt due to the natural spread of the pest, which for two or three years has been known to be near the borders of Connecticut in both Massachusetts and Rhode Island. A systematic examination must be made of this region after the leaves drop, combined with the destruction of all winter nests found.

During the past few weeks nearly all of the birches known as the white, gray, or bobbin birch, *Betula populifolia*, have been defoliated by the birch bucculatrix, *Bucculatrix canadensisella* Chamb., throughout the northern and eastern portions of the state. This insect, though a pest in northern New England and in certain seasons in Massachusetts and Rhode Island, has not during my residence of over sixteen years in Connecticut shown any such outbreak.

Other points worth noting in this paper are the increasing damage

to shade trees by the leopard moth, *Zeuzera pyrina* Linn., which is boring in the branches of various kinds of trees in the cities, and by the woolly maple leaf scale, *Phenacoccus acericola* King, which here confines its attacks chiefly to the sugar maple. The maple borer, *Plagionotus speciosus* Say, is still a serious pest of sugar maple shade trees in towns and cities, over sixty adults being taken by the gypsy moth men in Wallingford during their work of turning bands. Though this insect is not considered as a forest insect, the writer has seen its damage in wooded areas of perhaps twenty-five acres in extent in western Massachusetts and in New Hampshire.

The elm leaf beetle has done great damage in certain parts of the state, especially where the elms were not sprayed last season; but in New Haven, Milford, and other places where a systematic spraying of the trees was practiced in 1909, beetles have been rather scarce, though in most of these towns spraying has again been practiced this year.

Scientific Notes

BUCCULATRIX CANADENSISELLA CHAMB.—The work of this Tineid, which has this year been very abundant and destructive in many parts of New England, has been observed on the birches (*Betula populifolia*), throughout Rhode Island, up through Eastern Massachusetts, west as far as Springfield, Mass., and north to Manchester, N. H., and to about 12 miles west of Nashua, N. H. According to advices sent us by Captain Philbrook, it is present in Maine as far east as Augusta and he has also noticed it in Waterville. At Melrose Highlands, where it has been very common, the small white moulting cocoons of the larvæ were first noticed on the leaves of the birches on August 29. The pupal cocoons were first observed in the field September 9th, and on the 10th the larvæ, which had been abundant on the leaves a few days before, had almost all disappeared. As a result of the work of this insect, the leaves of the majority of the birches in the woods about here are prematurely dead, brown and shrivelled, and this condition has been reported from a great many localities throughout the infested area.

WILLIAM R. THOMPSON.

DISCUSSION AND CORRESPONDENCE

Food of the Bobwhite

I must protest against the undue praise given by Prof. C. F. Hodge to a paper[1] on the Food of the Bobwhite, published in the June number of The Journal. This account adds nothing to the publications by Dr. Sylvester D. Judd of the U. S. Biological Survey, except what is based on tests as to the choice of food by practically domesticated birds.

For many reasons feeding experiments with confined birds are useless as furnishing analogies to the conduct of individuals of the species under natural conditions. It is almost impossible wholly to remove the factor of human choice of the food. Moreover the usual change in amount of exertion by the birds, the absence of enemies, and other changed conditions make different impulses and behaviour almost unavoidable and certainly result in a different attitude toward food. There are no better illustrations of the effects of confinement than animals in zoölogical gardens. As is well known, very few of them get their natural diet and some, indeed, will not thrive on any thing like their natural food, or conversely, they do thrive on a regimen they never experience in nature. For instance, the anteaters and the solenodon in captivity subsist on hard boiled eggs. Is it not just as reasonable to draw an analogy here as in the case of quails fed clothes moths, mosquitos and house flies?

A few instances from records of feeding experiments by the Biological Survey will further show the fallacy of basing conclusions as to economic value on the behaviour of captive birds. A shrike willingly devoured a goldfish and a black bass; items of food it probably never gets in the wild state. A bluejay refused to eat acorns, dozens of which were found in collected stomachs; disdained beech nuts, another favorite natural food, and would not touch a live English sparrow nor a mouse, though both birds and mice have been found in the stomachs of wild birds. A caged bluebird refused the ground beetle, *Scarites subterraneus*, but wild ones eat it. English sparrows would not eat dandelion heads, though free birds are commonly observed rifling them of their seed. Bobwhites tested here refused plant lice; those tested by Mrs. Nice ate them freely. A confined song sparrow rejected

[1] Food of the Bobwhite. Margaret Morse Nice, Clark University, Worcester, Mass. With an introduction by C. F. Hodge. Journ. of Economic Entomology. Vol. III, No. 3. June, 1910. Pp. 295–313.

Diabrotica and *Hippodamia*; both have been revealed by examinations of the stomachs of wild birds. Perhaps the most surprising case is of a song sparrow refusing seeds of lamb's quarters, and smartweed, and finally only being starved into eating seeds of pigweed. Under natural conditions these are favorite foods.

Such instances clearly show the futility of experiments on confined birds in so far as learning food preferences is concerned. It will be readily admitted that such experiments are even more disappointing when data as to the quantity of food consumed by wild birds is desired. The only way to determine accurately the economic value of the various species of birds is to learn their relations to other organisms under the unmodified conditions of areas voluntarily inhabited by wild individuals. Experience has shown that the best, if not the only thoroughly reliable methods, are the analysis of authentic pellets, or fæces, or the contents of the crop, gizzard or other parts of the alimentary canal. Hence the paper under discussion, all original information in which is based on studies of captive birds, fails as a contribution to knowledge of the economic value of the bobwhite.

The fact that numerous names of weeds and insect pests were added to the list of seeds and insects found in collected stomachs by Judd is of no significance. Beneficial insects and cultivated fruits and grains could just as well have been fed to the birds and a directly opposite impression given. But in neither case would the result be a guide to the behaviour of the bobwhite under natural conditions. A knowledge of that behaviour, and that only, is of value in determining the economic status of a species.

W. L. McAtee.

AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

The twenty-third annual meeting of this Association will be held at Minneapolis, Minnesota, during the Christmas holidays.

Active and associate members will receive further notice concerning the meeting and blanks will be sent so that the titles of papers can be entered and returned to the Secretary before the program is made up.

Foreign members should forward to the Secretary, at once, the titles of papers which they wish to present at this meeting and the manuscript should be mailed so that it will arrive on or before December 15, 1910. It is impossible at this time to furnish foreign members with the exact dates and hours when the sessions will be held but the Secretary will take pleasure in supplying, as promptly as possible, any information that will be of assistance to members who expect to be present.

A. F. Burgess, *Secretary, Melrose Highlands, Mass.*

JOURNAL OF ECONOMIC ENTOMOLOGY

OFFICIAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

OCTOBER, 1910

The editors will thankfully receive news items and other matter likely to be of interest to subscribers. Papers will be published, so far as possible, in the order of reception. All extended contributions, at least, should be in the hands of the editor the first of the month preceding publication. Reprints may be obtained at cost. Contributors are requested to supply electrotypes for the larger illustrations so far as possible. The receipt of all papers will be acknowledged.—EDS.

The wide dissemination of scientific matter, particularly of an economic character, is highly desirable. There has been a gratifying advance along this line in recent years. This is especially true of the agricultural press. Late discoveries respecting insects and their part in the dissemination of disease has stimulated the demand for this type of information, and magazines of standing are giving considerable space to various phases of the work. We recently noted in one monthly of excellent standing, a caution respecting the admission of even a single fly into the house, the statement being made that such was very likely to result in a large multiplication and consequent abundance of the pest. The obvious inference from the context was that the flies multiplied in the house, and we have since been wondering in what section of the country the author resided. We have not been privileged so far to enter many American homes where flies would multiply indoors to any great extent, at least. About the same time another magazine published an excellent article on South African locusts or grasshoppers, accompanying it by a fine series of illustrations showing the transformations of our so-called 17-year locust or periodical Cicada. There was no direct statement to the effect that the illustrations represented an insect substantially identical with the South African locust, yet the lay reader would be justified in assuming such to be the case. Errors are to be expected in the daily and weekly press and are sometimes unavoidable in the presumably more carefully edited monthlies. Our popular magazines are doing an excellent work in giving much attention to practical or applied entomology and we feel that this should not be marred by such obvious errors as those cited above.

The proceedings of the annual meeting, assembled in early January, means an abundance of copy for the February and April issues, with possibly some papers read by title only being carried over to June. Notes for the year from various sections of the country are very useful records, and as a rule there should be little

difficulty in preparing such for publication in the October and December issues—numbers much less likely to be crowded with matter than the following two issues. One such paper appears in the current number, and it is to be hoped that there will be several in the December issue. Early publication should not operate to limit discussion, and in many instances would be of great value because of the opportunity for looking up doubtful points. We would also take this opportunity of calling attention to the importance of placing on record minor observations as Scientific Notes. Many of these, while small in themselves, mean a substantial addition to knowledge in the aggregate, and in altogether too many instances they are buried in a mass of notes or forgotten, often to the detriment of workers in allied lines.

Reviews

The New Mexico Range Caterpillar, by C. N. AINSLIE, U. S. Dept. of Agriculture, Bureau of Entomology, Bull. 85, Part V (1910), p. 59–96.

This admirable bulletin contains a full account of *Hemileuca oliviæ*, an insect which has been until recently very rare in collections, but has now appeared in immense numbers in northern New Mexico, the larvæ destroying the range grasses. The species belongs to a group of closely allied forms inhabiting principally the tablelands of Mexico, and probably all grass-feeders. Doctor Dyar has contributed a section on the taxonomy of *H. oliviæ*, giving full descriptions of all the stages, and a discussion of the related forms. The authorship of this section is stated in the introduction, but it should have been given also at the beginning of the section, where it would be noticed by bibliographers. The whole life history of the insect has been carefully worked out by Mr. Ainslie, and is very well worth reading for its biological interest. It is perhaps probable that *H. oliviæ* is a relatively recent segregate from the Mexican group, resulting from some migrant which possessed characters enabling it to successfully multiply far out of the range of the parent type. Even now the adjustment seems incomplete, for the moths emerge in the fall, and very many perish in the cold and snow. It was also ascertained that the heat of the bare ground is fatal to the larvæ; when placed upon it "only in rare instances did any survive when the distance to be traversed equalled 24 inches." Pupation takes place principally among the branches of a species of Compositæ, *Gutierrezia sarothræ*; and Mr. Ainslie notes that the overstocking of the range has reduced the nutritious grasses and led to the increase of this weed, which now greatly facilitates the spread of the *Hemileuca*, which in its turn further reduces the grasses.[1] Owing to this condition, it is impossible to say how widely the insect may spread, or how much damage it may do. Mr. Ainslie describes the defensive fluids of the moths, and remarks that it is curious that they should be so well equipped for defense against enemies which in New Mexico appear to be non-existent. He also notes

[1] However, as I noted from specimens sent to me by Mr. Frank Springer, the *Gutierrezia* is severely attacked by the Cecidomyiid *Rhopalomyia gutierreziæ* (Ckll.).

that while several hymenopterous and dipterous parasites were bred, the insect-parasition is quite low, about half a per cent. All this again may be indicative of migration from some other region.

On page 61 Mr. Ainslie states that " the first authentic history of the genus *Hemileuca* in New Mexico begins about five or six years ago." This is a very extraordinary statement, difficult to comprehend. Mr. Springer wrote me that the pest had been noticed in Colfax County for about ten years. The original *H. oliviæ* was described from Santa Fe, New Mexico, in Psyche, Aug. 1898. Later in the same year, also in Psyche (p. 298), the larva was briefly described and the grass-feeding habit noticed. *Hemileuca artemis* Packard, a *Populus*-feeding species, was described from Las Cruces, New Mexico, as early as 1893 (Proc. Amer. Phil. Soc., p. 172). *H. juno* Packard also occurs in the Mesilla Valley, but I think the record has not been published. *H. tricolor* Packard, 1872, is from New Mexico.

T. D. A. COCKERELL.

Report of the Field Work against the Gipsy Moth and the Brown Tail Moth, by D. M. ROGERS and A. F. BURGESS. U. S. Dep't. Agric., Bur. Ent. Bul. 87, p. 1-81, 1910.

American literature relating to these two species has increased greatly in recent years. The continuous spread of the gipsy moth and the wide dissemination of the brown tail moth has necessitated large appropriations in recent years, both on the part of infested Commonwealths and the Federal Government. The bulletin under consideration is an excellent summarized account of the work against these two species, it being particularly valuable because of the description of the improved methods now in vogue and the careful discussion of the problems involved in the future control of these species. The authors are to be congratulated upon having produced a bulletin which states the situation fairly and in a manner intelligible to all. We trust that this publication will be widely distributed, since it is very important that all citizens resident in the Northeastern United States, at least, should have authentic information respecting the work against these two dangerous insect pests.

Plant Bugs Injurious to Cotton Bolls, by A. W. MORRILL. U. S. Dep't. Agric., Bur. Ent. Bul. 86, p. 1-110, 1910.

This important publication summarizes our knowledge respecting a considerable number of the plant bugs affecting cotton and places on record a large amount of original information. The discussion of the Conchuela, *Pentatoma ligata* Say, a species which may destroy from 5 to even 30% of all the bolls in a cotton field, is exceptionally full and is based on Dr. Morrill's studies in northern Mexico and western Texas. It is a valuable, detailed account of one of our injurious Hemiptera. This bulletin is one of the incidental results of the extended investigation conducted by the Federal Bureau of the cotton boll weevil and other insect enemies of this staple crop. This publication is illustrated by an admirable series of figures.

The Codling Moth and How to Control it by Spraying, by E. DWIGHT SANDERSON. N. H. Agric. Exp't. Sta. Bul. 143, p. 61-106, 1909.

This is a summary account of the life history of this species, based in large measure upon the author's extended investigations. It is particularly interesting to the

economic entomologist on account of the data given, showing the increased spraying in New Hampshire during recent years. The summaries of reports from fruit growers in different sections of the state are undoubtedly of value, since such statements are frequently very encouraging to the orchardist. The excellent series of illustrations adds greatly to the value of this popular bulletin.

The Sorghum Midge, by W. HARPER DEAN. U. S. Dep't. Agric., Bur. Ent. Bul. 85, Prt. 4, p. 39-58, 1910.

This bulletin is an excellent, comprehensive account of *Contarinia sorghicola* Coq., a recently described species now recognized as an important enemy of Sorghum. The biological data is particularly interesting, since we know altogether too little respecting the life histories of the numerous American species of Cecidomyiidæ. Under remedial measures the author advises the destruction of Johnson grass and the seed heads of the first crop in connection with clean harvesting, the idea being to restrict breeding early in the season, either in wild plants or in the early crop, and thus prevent its becoming excessively abundant toward the end of the season. Small crops of seeds can easily be secured by bagging the heads. The admirable series of original illustrations adds greatly to the value of this publication.

Snout Beetles that Injure Nuts, by FRED E. BROOKS. W. Va. Agric. Exp't. Sta. Bul. 128, p. 145-85, 1910.

This attractively illustrated bulletin gives in concise form the results of investigations of nut weevils extending over a series of years. The accounts, while popular, add much to our knowledge of these insects. The author gives references not only to the technical descriptions of the species described, but also to the more important papers treating of their biology. In addition to fumigation and the destruction of infested nuts, the author advises the cultivation of the soil for the purpose of breaking up the hiding places of these pests and thus exposing the larvæ and pupæ to the air and their natural enemies. His suggestion respecting the trapping of the beetles in dead leaves is most interesting and must prove of great practical benefit. The bulletin is well illustrated.

Three Snout Beetles that Attack Apples, by FRED E. BROOKS. W. Va. Agric. Exp't. Sta. Bul. 126, p. 105-24, 1910.

This is a well illustrated, popular account of the plum curculio, apple curculio and apple weevil, species which have been responsible for several years past, for knotty and wormy fruit in West Virginia. The author states that in the past, sound fruit has often been the exception rather than the rule, and in many cases almost the entire crop has been next to worthless. The local data given by the author will be of great service in future studies of these important insect pests.

Ninth Report of the State Entomologist, 1909, by W. E. BRITTON. Conn. Agric. Exp't. Sta. Biennial Rept. 1909–1910. Prt. 4, p. 325–374.

This public document is exceptionally interesting to the economic entomologist because of the detailed information respecting the occurrence of the gipsy moth at Wallingford and the progress made in extermination. An earlier note in this issue, page 435, shows that the campaign against this pest has been exceptionally successful. Similar infestations are likely to be found in other parts of the coun-

try, and the experience gained by Professor Britton at Stonington and Wallingford will undoubtedly prove of much service in handling similar problems in other sections. The rosy apple aphis, *Aphis sorbi* Kalt, which was exceedingly abundant in Connecticut, is discussed in detail, technical descriptions being given of the various stages. Among other important insects noticed are the bud moth, *Tmetocera ocellana*, the leopard moth, *Zeuzera pyrina*, and the peach borer, *Sanninoidea exitiosa*, together with minor observations upon a number of injurious species. The value of this report is greatly increased by an admirable series of illustrations, especially those showing the characteristics of gipsy moth infestation.

Current Notes

Conducted by the Associate Editor

Mr. George G. Becker has been appointed assistant in Entomology at the Arkansas University and Agricultural Experiment Station at Fayetteville, Ark.

Professor Clarence P. Gillette has recently been appointed Director of the Agricultural Experiment Station at Fort Collins, Colorado, in place of L. G. Carpenter, resigned.

Dr. H. T. Fernald, State Inspector of Massachusetts, attended a meeting of Massachusetts Nurserymen at Boston, June 11th, when an organization was formed, to be known as the Massachusetts Nurserymen's Association. Several states now have such organizations and the result will doubtless tend to improve the condition of certain nurseries and encourage a reasonable interpretation of the inspection laws and regulations.

Professor R. S. Mackintosh, who has for several years served as Horticulturist of the Alabama Experiment Station, and has been in charge of nursery inspection and quarantine work, has resigned to accept a position in the investigation of peach culture problems at the Pennsylvania State College. His successor is Professor P. F. Williams, formerly assistant to Professor Mackintosh, and a graduate of the Massachusetts Agricultural College in the class of 1905.

Mr. W. S. Griesa, proprietor of the Mount Hope Nurseries, Lawrence, Kansas, has established, in memory of his father, the late A. C. Griesa, a research followship in entomology at the University of Kansas. Mr. H. W. Lohrenz, a graduate research student of entomology in the University of Kansas, has been appointed to this fellowship and began his work on the fifteenth of June.

At the first International Congress of Entomology held last month at Brussels, the Entomological Society of America was represented by Dr. W. J. Holland of Pittsburg, Pa., Professor Herbert Osborn of Columbus, Ohio, and Dr. Henry Skinner of Philadephia, Pa. The second International Congress will meet at Oxford in 1912 on the invitation of Professor E. B. Poulton.

Mr. W. C. O'Kane, Assistant Entomologist of the New Hampshire Agricultural Experiment Station at Durham, N. H., has been appointed Entomologist of the same Station in place of Professor E. D. Sanderson who resigned recently to become Dean of the College of Agriculture of the University of West Virginia, Morgantown, W.

Va. Mr. O'Kane will also be Professor of Economic Entomology in the New Hampshire College.

Mr. John A. Grossbeck, Assistant in the mosquito work of the New Jersey Agricultural Experiment Station at New Brunswick, N. J., resigned his position August 1st to accept a position as Assistant in the Department of Invertebrate Zoology of the American Museum of Natural History of New York City.

Mr. J. B. Garrett, Assistant Entomologist of the Agricultural Experiment Station at Baton Rouge, La., has been made Entomologist of the same station, succeeding Mr. Newell, who resigned to accept a position as State Entomologist of Texas. Mr. Newell's new position has already been noted in this Journal (see page 111).

L. M. Peairs, Assistant in Entomology at the Maryland Agricultural Experiment Station, has been appointed assistant entomologist of the Kansas Station.

Prof. C. H. Fernald of the Massachusetts Agricultural College, owing to the infirmities of advancing years, has retired from active work and has been appointed Honorary Director of the Graduate School. He has been connected with the institution for twenty-four years and a goodly number of our more promising, younger entomologists have received their preliminary training under his direction. His son, Prof. H. T. Fernald has been appointed Acting Director of the Graduate School and also succeeds his father as Entomologist of the Station.

Dr. E. A. Bach has been appointed State Entomologist of Virginia and Entomologist of the Agricultural Experiment Station.

Dr. Burton E. Gates has been appointed to the newly established position of Assistant Professor of Bee Culture at the Massachusetts Agricultural College and State Inspector of Apiaries.

E. G. Titus, Entomologist of the Agricultural Experiment Station, Utah, is spending a year's leave of absence in special study at Harvard University.

Mailed, October 15, 1910.